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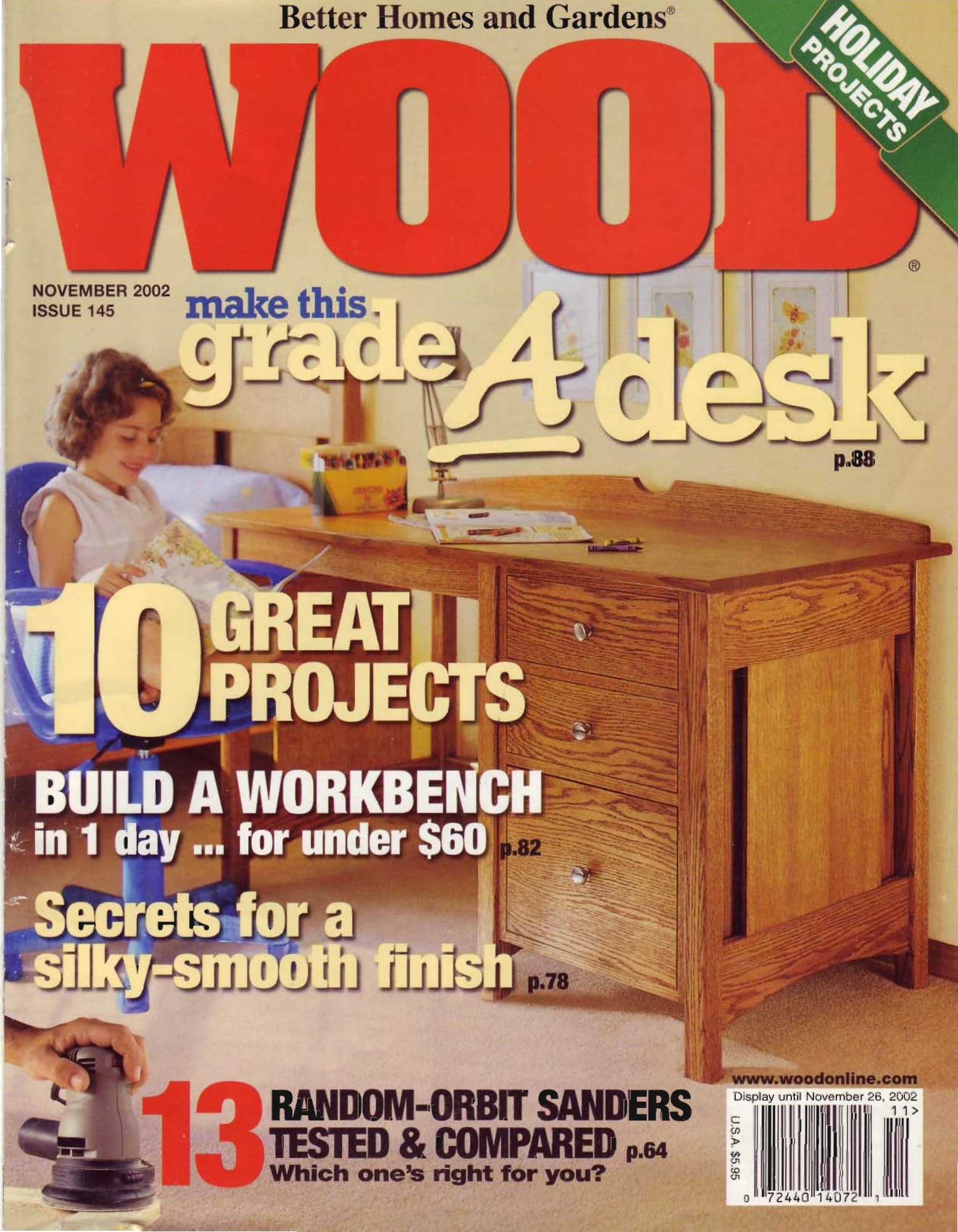
HOLIDAY PROJECTS

NOVEMBER 2002
ISSUE 145

make this grade A desk

p.88



10 GREAT PROJECTS

BUILD A WORKBENCH in 1 day ... for under $60

p.82

Secrets for a silky-smooth finish

p.78

13 RANDOM-ORBIT SANDERS TESTED & COMPARED

p.64

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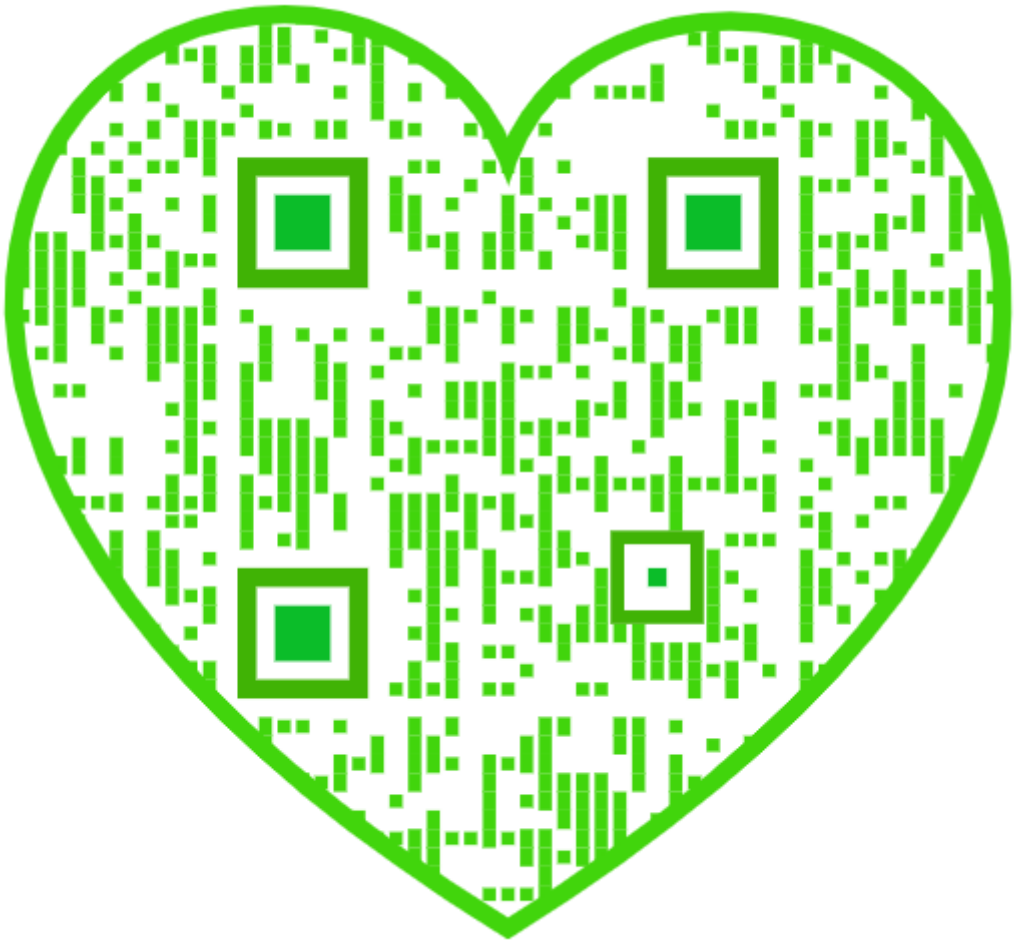

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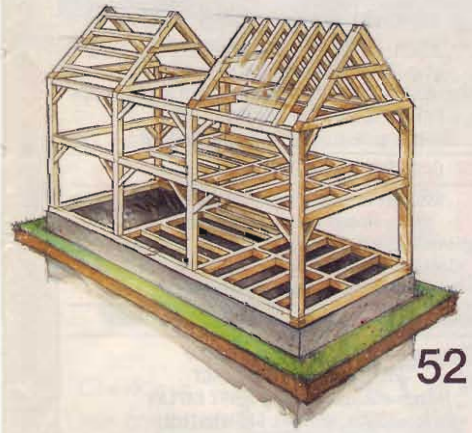
This seal is your assurance that we build every project, verify every fact, and test every reviewed tool in our workshop to guarantee your success and complete satisfaction.

contents

WOOD® magazine November 2002, Issue 145

42


52

60

PROJECTS

12 simple marking gauge
42 sit-a-spell hall bench
48 country coatrack
58 arched candle holder
60 mission-style shelf clock
70 child-pleasing pendulum cradle
74 scrollsawn tree ornaments
76 reindeer winter scene
82 one-day workbench
88 grade A desk

TECHNIQUES

14 **marking gauge know-how**
See how this traditional hand tool will improve your woodworking accuracy.

20 **give angled corner splines a try**
With a simple tablesaw jig, add a decorative look to boxes, trays, and other projects.

26 **dealing with wood defects**
Save money by salvaging less-than-perfect lumber with this bag full of tricks.

78 **rubbing out a finish**
Enhancing the sheen of your projects is a lot easier than you may think.

TOOLS & MATERIALS

29 **battery-fired brad nailers**
Catch the latest in three ground-breaking tools that have gone hoseless.

64 **random-orbit sanders**
We test 13 models to see which ones provide the finest and fastest results.

96 **shop-proven products**
Don't miss these hot new tools.

FEATURES

24 **is your finish food-safe?**

52 **timber framing from the ground up**
Now this is how a woodworker builds a house, fancy joints included.

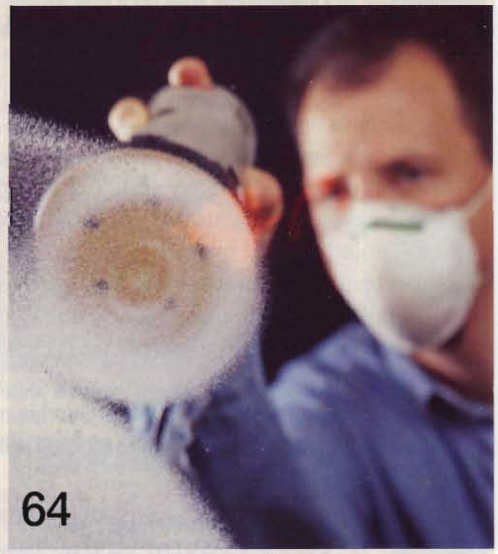
DEPARTMENTS

4 editor's angle
6 sounding board
16 ask *WOOD*
31 wood anecdote
32 shop tips
40 at your service
112 what's ahead in our next issue

70

74

82


64

sounding board

Our bulletin board for letters, comments, and timely updates

Woodworking warriors do battle in the warehouse

In late July, *WOOD*® magazine sent its top craftsmen and designers to compete in the popular cable reality show *Warehouse Warriors* on DIY—The Do It Yourself Network. The *WOOD* crew and their opponent from another magazine were challenged to design and build an armoire in eight hours using only the materials on hand. Did you get that? Eight hours! Who won? You'll have to tune in to find out. Trust us, the quality, creativity, and craftsmanship of the entries will blow you away. Here are the episode's broadcast times for the network's fall lineup:

DATE	TIME (EST)
October 14 (premier)	9:00 p.m. 12:00 a.m.
October 19	10:00 p.m. 1:00 a.m.
November 20	9:00 p.m. 12:00 a.m.
November 24	10:00 p.m. 1:00 a.m.

***WOOD* magazine's team (from left in red shirts) Jeff Mertz, Chuck Hedlund, and Kevin Boyle pose proudly, along with DIY carpenter Jay Baker, before the armoire they designed and built in just eight hours while competing on TV's *Warehouse Warriors*.**

Amusing observations from a woodworking rookie

Whether you've been working with wood for a short time or a lifetime, it's hard to forget the rush of excitement derived from your early days in the shop. Here's how Scott Spencer, a newcomer to the craft, humorously expressed his feelings about his hobby while participating in the General Woodworking forum at www.woodonline.com:

- My shop is too small.
- My "rookie" season might last a couple more years.
- I don't have enough tools.
- Deck-building tolerances and furniture-building tolerances aren't the same.
- I filled a garbage can with sawdust!
- The square from the "$1 store" isn't.
- Friends and neighbors won't notice the 41 flaws in a project.
- Having ten fingers is a blessing.
- I don't have enough clamps.
- It looks so easy when Norm does it.
- "Square" is not a given.
- Measure twice and take 3 or 4 nibble cuts until you build up your confidence.
- I hate tear-out.
- Biscuits are your best friends.
- Sawdust is everywhere.
- You "nuts" who spent hundreds for a dust collector....well, you aren't...
- Because I have a tablesaw, my neighbors think I do plumbing too.
- Every step takes three times longer than I thought it would.
- The WOOD Talk forums are cool.
- Staining and topcoating a project is fun for about 30 minutes.
- It takes at least 3 hours to stain and topcoat a project.
- Tossing scrapwood is hard to do.
- The guys who took woodshop in school were smarter than I thought.
- Giving the kids a dollar to sweep up the sawdust only works twice.
- Kickback is as dangerous as everyone says it is.
- Every new project justifies a new tool.
- My lawn doesn't look as nice as it used to, and I don't care.
- I stare at my creations for hours.
- I'm lovin' every minute of it!

—Scott Spencer, Rochester, New York

Continued on page 8

In praise of the Patriot's Plaque

Thank you for the plans for the Patriot's Plaque (issue 139, shown *below right*). They arrived just as I started Rookie School for the Boulder City, Nevada, Fire Department.

In our department, each graduating class traditionally makes a plaque to celebrate and to thank those who trained us. As our class started talking about what we were going to do for our plaque, I came back to the issue and started working on the flag project.

Instead of painting it, I used maple and cherry for the stripes, and black walnut for the star field. The flag is mounted to an aluminum diamond-plate backing, with metal offset-printed plates bearing everyone's names and a message of gratitude. I think the overall impact is phenomenal. Thanks again from the rookie class of the 2002 Boulder City Fire Department!

Tim Mikita, Boulder City, Nevada

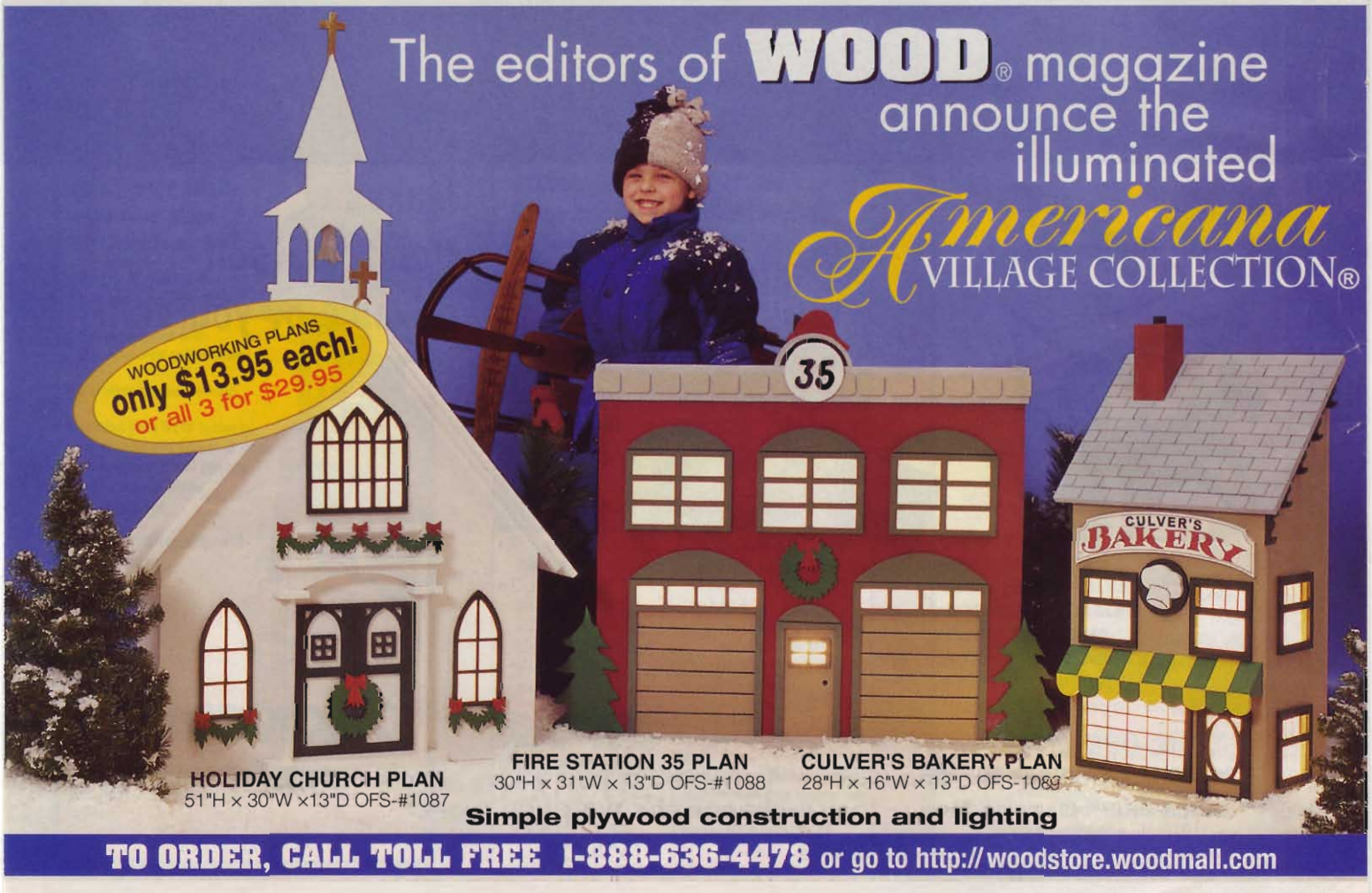
Write Us!

Do you have comments, criticisms, suggestions, or maybe even a compliment specifically relating to an article that appeared in *WOOD*® magazine? Please write to:

Sounding Board
***WOOD* magazine**
1716 Locust St., GA-310
Des Moines, IA 50309-3023

or, if you prefer, you can send us an e-mail at **soundingboard@woodmagazine.com.**

Due to the volume of letters and e-mails we receive, we can respond to and publish only those of the greatest interest to our readers.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Simple but effective marking gauge

In a short evening, you can turn a few scraps of wood into an accurate, easy-to-use layout tool.

It's tough to beat a marking gauge for creating crisp, repeatable layout lines. Consisting of a beam, a sliding fence held in place by a small wedge, and a scribing point, this time-tested tool sets up quickly. (To learn how to use it, see "A Case for Marking Gauges" on *page 14*.)

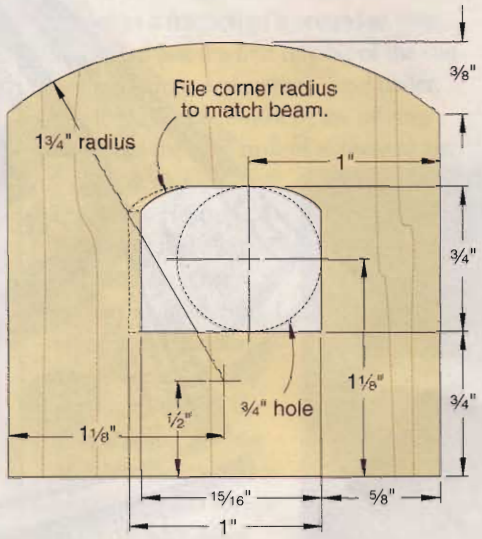
To build one, start by cutting the beam to the size shown in the drawing, *right*. Then, to create the thumbnail profile on one edge, chuck a ½" round-over bit in your table-mounted router, and rout the partial round-over using just a portion of the bit. Now drill a hole near one end to receive a 6d finish nail. Insert the nail, allowing the point to project ⅛". Cut off the head leaving ⅛" exposed on that end, as well. Then sharpen both ends to create the scribing pin.

Make the wedge by tracing the full-size pattern onto a piece of ⅝×4×2" stock, running the wood's grain lengthwise. (An oversize piece is safer to handle as you shape the wedge.) Bandsaw the wedge to shape and then sand it smooth so it slides easily against the beam and fence.

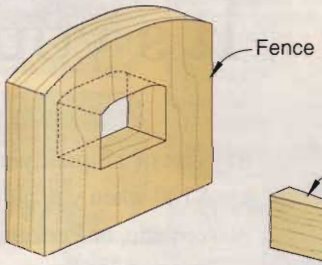
To create the fence, first cut it to shape using the full-size pattern as a guide. Next, bore a ¾" hole through the fence where dimensioned. Using chisels, a flat file, and a round file, expand the hole, and shape it into an opening that fits the beam and wedge. Note that one side of the opening tapers to match the wedge. Be sure to test-fit the beam and wedge periodically as you shape the opening.

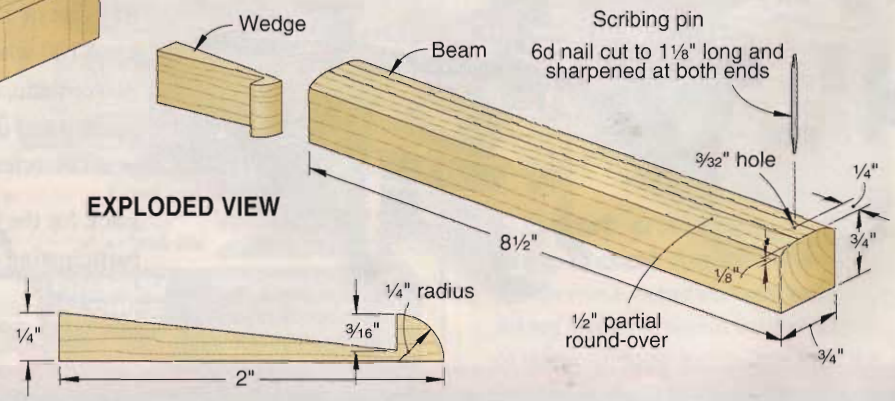
To protect the marking gauge, top it off with a couple of coats of oil finish.

Written by **David Stone**
Project design: **Kevin Boyle**
Illustrations: **Mike Mittermeier; Lorna Johnson**
Photograph: **Marty Baldwin**



FULL-SIZE FENCE PATTERN

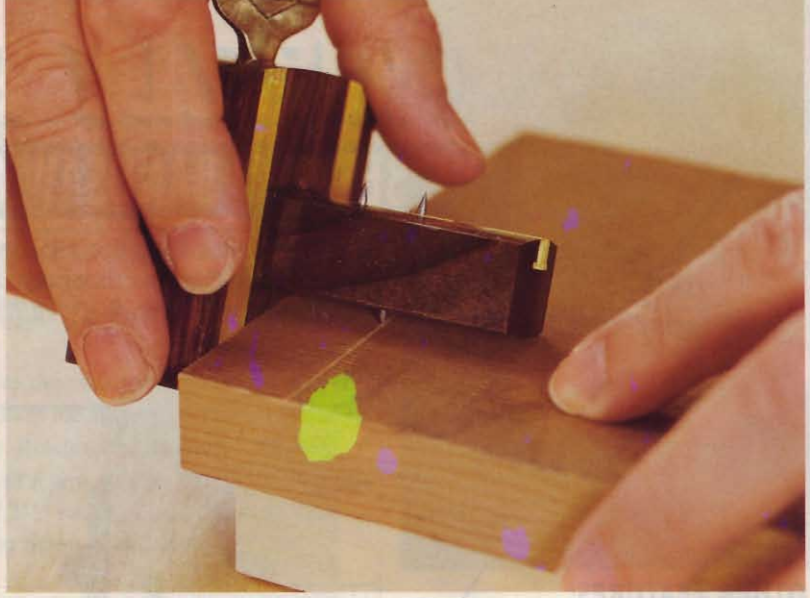




EXPLODED VIEW

FULL-SIZE WEDGE PATTERN

a case for marking gauges



When it comes to marking cutlines and laying out joints, it's hard to beat the simplicity and accuracy of a marking gauge. To uncover the fundamentals of marking gauge setup and use, we consulted renowned master craftsman Frank Klausz. Here's how Frank gets the most from his favorite layout tool.

What a marking gauge can do for you

A marking gauge provides a fast and accurate way to mark lines parallel to the edge of a workpiece, either with the grain or across it. A marking gauge's advantage over a pencil is that its pin, which Frank sharpens to a knife edge, produces a very fine mark that does not broaden, and it scores the workpiece for chiseling and saw cuts (preventing splintering). Here are a number of ways you can use one:

- Mark the center of boards for resawing.
- Mark stock edges for joining.
- Lay out lines for cutting joints, such as dovetail or mortise and tenon.

The gauge's parts

The basic marking gauge consists of four parts: an 8– to 12"–long beam, a fence, a fence-locking device, and a marking pin, as shown on **Drawing 1**. The fence slides along the beam to set the required marking distance to the pin. A locking device, such as a thumbscrew or wedge, secures the fence to the beam at the set position. Some gauges have a removable marking pin, which makes it easy to sharpen the pin or replace it. Also, the beams of some gauges are ruled to allow for direct setting of the marking dimension without the need for measuring.

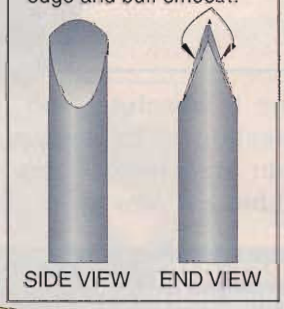
One type of marking gauge, a mortising gauge (photo *above*), has a single marking pin for general layout and another pair of pins on the opposite side of the beam for easy mortise layout. One pin is fixed and the other slides in the beam to set the mortise width.

Let's get to the point

For a marking gauge to work correctly, Frank notes, you need to focus your attention on its smallest part—the marking pin—and make sure it has the correct shape, projection, and angle.

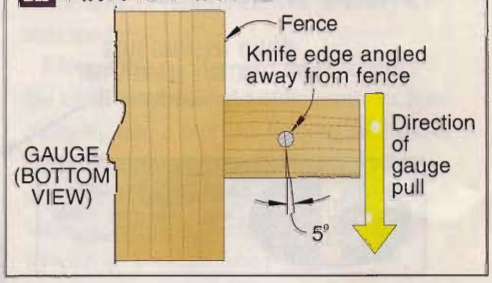
- **Shape:** Most new marking pins have a conical point, which will tear wood fibers rather than slice through them. To prevent this, sharpen the pin to a knife edge, as shown on **Drawing 1a**.

1a PIN SHAPE DETAIL



- **Projection**: For best control, adjust the pin so it projects 1/16" from the beam.
- **Angle**: Because a gauge works best when you pull it toward you, angle the point approximately 5° away from the fence, as shown on **Drawing 1b**. The angled pin will draw the fence against the edge of the stock when marking.

1b PIN ANGLE DETAIL

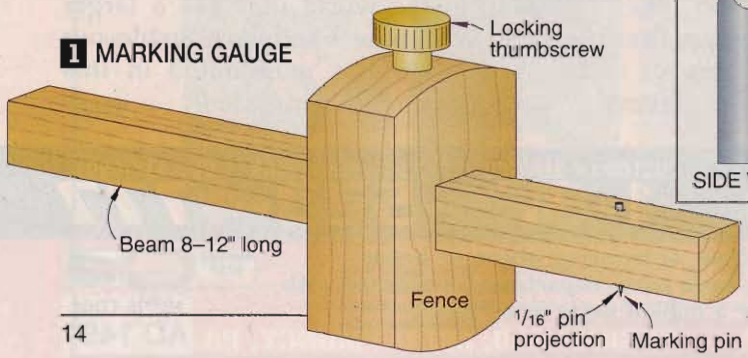


Tips for using a gauge

- Because the fence follows the stock's edges, make sure they are straight and smooth for accurate marking.
- After securing the fence, recheck the setting to be sure it hasn't changed. Practice marking on scrap first to verify the setting.
- Position the fence against the stock's edge, and apply light pressure to keep it flush. Rotate the beam so the pin is at an angle to the stock (as in the photo *above*), then lightly drag the gauge to make your mark.

Frank Klausz, of Pluckemin, NJ, works out of his unpretentiously named "Frank's Cabinet Shop."

1 MARKING GAUGE



ask wood

Answers to your questions from letters, e-mails, and WOOD ONLINE®

Steel buildings look a lot different inside than conventionally framed ones. On-wall storage is a factor to consider, too.

Steel vs. wood for a workshop

Q After working in my basement for a number of years, I'm going to take the plunge and put up a detached building as a workshop. What are the advantages and disadvantages of all-steel kit buildings, as compared with a conventionally framed and sided building?

—Bill Shaw, St. Paul, Minn.

A Bill, if you're thinking about a large building, steel is the more practical choice; you can have a wide, tall space without any interior supports. For a more typical workshop, comparable in size to a two-car garage, the decision gets more complicated.

Steel and bolts certainly produce a strong, solid building, but make sure you won't have problems with rust on the outside or condensation on the inside. Before you buy from a particular company, ask for names of previous buyers in your area, and arrange to inspect one yourself.

If that building looks sound, figure out how much time, effort, and money it will take to give interior walls the appearance you want, and how you'll provide for on-wall storage. The combination of steel and, in some cases, a curved wall calls for a different approach than a conventional building. Also, look into any local building regulations that might affect your choice.

Once you've decided what you want in terms of square footage, doors, and windows, compare the cost of one building style with the other. We asked at a home center for a rough estimate on a conventionally built building, compared those numbers to a steel kit price, and didn't find much difference.

Remember that kit prices generally don't include a concrete floor, wiring, heating and cooling, or insulation. Determine whether you'll need machinery to unload and move parts, and how many people you'll want to help with the construction. Finally, before you order, ask about guarantees, style options, and the availability of advice via phone.

Here's a list of steel kit manufacturers:

- Aztec Steel, 800/891-6733, www.steelspan.com
- Future Steel, 800/668-8653, extension 1333, www.futuresteel.com
- Miracle Truss, 800/663-0553, www.miracletruss.com
- Pioneer, 800/668-5422, www.pioneersteel.com
- Steelmaster, 800/341-7007, www.steelmasterusa.com
- U.S. Buildings, 800/463-6062, www.us-buildings.com

—WOOD® magazine

The straight story about jointers

Q I'm just starting to use a jointer, and so far the results are disappointing. I seem to put a bow into every board. What am I doing wrong?

—Bob Markel, Ann Arbor, Mich.

A Recheck your jointer setup, practice the right work habits, and you'll straighten out this problem, Bob. Unplug the machine, and make sure the knives are all set at the same height, and parallel to the infeed and outfeed tables. Then, set the outfeed table so that it's level with the cutting edge of a knife at the top of its rotation. If it's too high, you'll get a concave surface on your workpieces; too low, and you'll remove too much wood at the back end of the cut.

Before you run a board across the jointer, sight along the surface. If it's convex, let the ends go untouched by the knives for the first couple of passes while you smooth the middle portion. If it's concave, let the middle ride high while you mill the ends. On the final passes, apply downward pressure on the board over the outfeed table to keep the board flat.

—WOOD magazine

An aluminum straightedge, such as this torpedo level, can't nick jointer knives, so it's ideal for setting an outfeed table.

Continued on page 18

WIN FLOOR SEATS AND BEAUTIFUL WOOD FLOORS– COURTESY OF VARATHANE.®

Now you can achieve beautifully refinished wood floors by yourself with Varathane® Diamond Wood Finish premium polyurethanes. With Varathane the result is a professional finish with long lasting durability. And now, Varathane is giving you the opportunity to see your favorite pro basketball players in action. The **America's Most Flawed Floor Contest** will award one Grand Prize winner with everything needed to refinish their wood floors, including Varathane Diamond Wood Finish products, as well as two floor seat tickets to the most star-packed professional basketball game of the year (travel and hotel included).

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Start using stops to hold glass panels

Q What's the best way to secure a glass panel in a cabinet door? I planned to use glazier's points and silicone caulk, but I suspect there's another method that would give the project a nicer appearance.

—Dave Sykes, Carrollton, Texas

A We like wooden stops, Dave. They blend with the rest of your project to provide a much more professional look, they don't require a great deal of work, and they're easy to remove if you need to replace a broken pane of glass. A flat strip of wood set into the rabbet atop the glass does the job. If the front of the door has a routed profile along the inside edges, take the time to match that profile in your stops. Predrill several holes in the stop, making sure to stay clear of the glass, and attach the stop with small brads.

For a long-lasting, rattle-free panel, size the glass ¼" smaller than the opening, both horizontally and vertically. Fill the resulting ⅛" gaps with foam weather stripping or "Space Balls" (available from Woodcraft; call 800/225-1153 and order item number 142284 to get a package of 100 for $4.99). The glass fits snugly, but won't crack when the wood moves.

—WOOD® magazine

Carefully use a nail set to push the brad heads below the surface of your wood stop. Fill the holes with a putty that's close to your finished wood in color.

Got a question?

If you're looking for an answer to a woodworking question, write to **Ask WOOD, 1716 Locust St., GA-310, Des Moines, IA 50309-3023** or send us an e-mail at **askwood@mdp.com**. For immediate feedback from your fellow woodworkers, post your question on one of our woodworking forums at **www.woodonline.com**.

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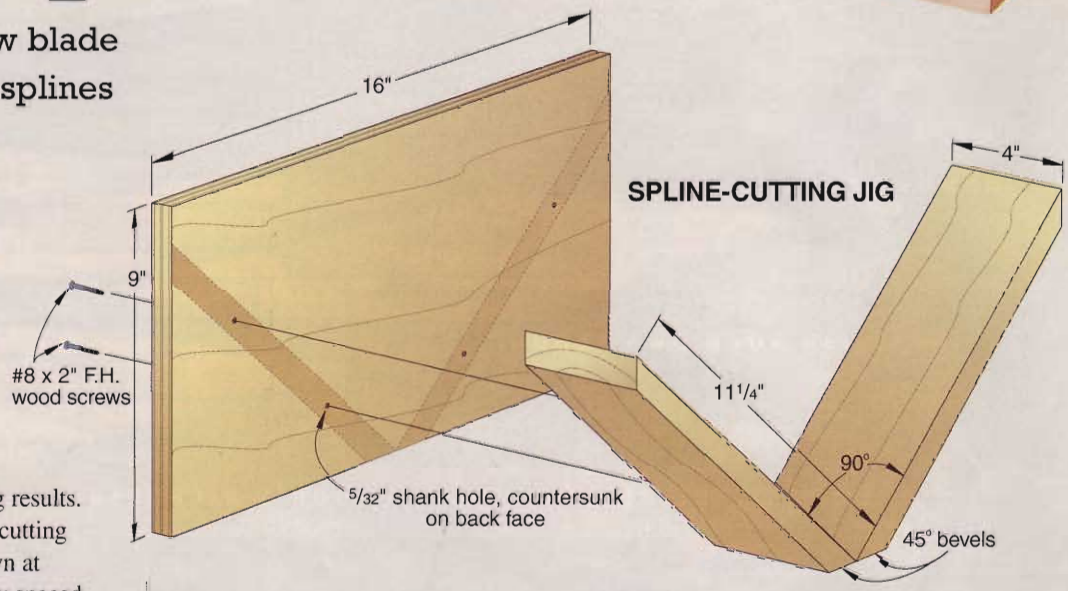
See Page 104

realign your splines

A slight tilt of a saw blade gives your corner splines a whole new look.



It doesn't take much work to put a new spin on traditional splined miter joints. Just install the splines at an angle, as we did *above* on a maple-and-walnut letter tray, and you get eye-catching results.

First, make a simple spline-cutting jig for your tablesaw, as shown at *right*. Then, mark three evenly spaced spline locations on a piece of scrap the same width as the tray side.

Install a blade in your tablesaw that produces the flattest possible kerf bottom. (We used an outside blade from our dado set.) Tilt the blade to 15°, and raise it so that it extends about halfway into the mitered corner. Set your jig against the tablesaw rip fence, place your marked scrap in the jig, and adjust the fence to cut a test slot. Now make the other slots, readjusting the fence between cuts.

When you're satisfied with the design, place clear packing tape around the workpiece corners to reduce chip-out. Hold the workpiece firmly in the jig, and cut as shown in **Photo A**. Cut the top slot in each corner, adjust the fence, cut all four middle slots, adjust again, and do the bottom slots. Remove the tape.

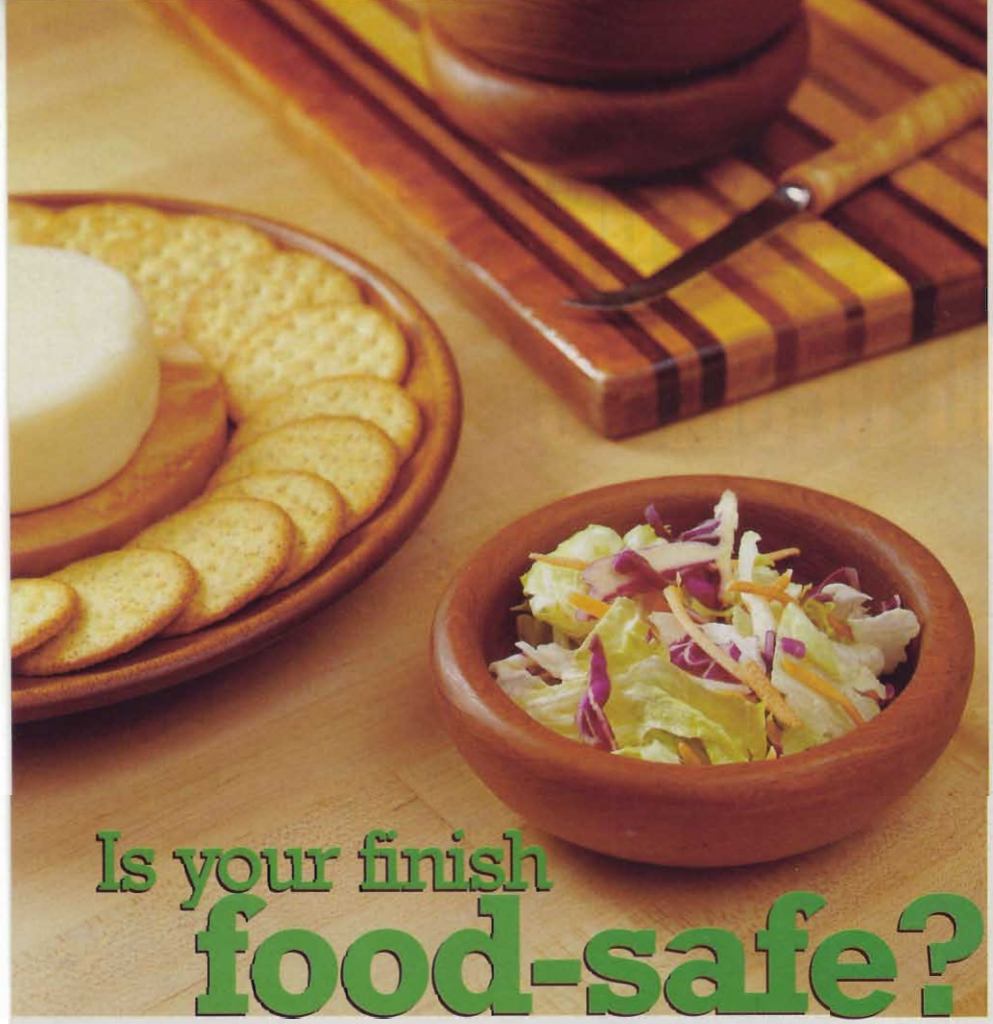
Rip spline stock from the edge of a board of contrasting stock, as shown in **Photo B**. Match its thickness to the kerf—usually ⅛". Then, cut individual splines from the strips, making them slightly longer than the slots. Spread yellow glue on the splines, slip them into place, and let the glue dry. Trim them off at the surface with a flush-cutting saw, or use a dovetail saw followed by a chisel. Sand flush.

By varying the number and placement of the splines, you can come up with other designs. You might try different saw blade angles, too.

Photographs: **Hetherington Photography**
Illustration: **Roxanne LeMoine**

Double-check the orientation of your workpiece before cutting. Here we're holding the bottom of the tray to the left, so the slots will point downward.

If one pass won't produce enough spline stock, clamp a stop to the table before ripping. Slide the fence between cuts to set the board against the stop.



Is your finish food-safe?

Let us put your mind at ease.

Wood finishes contain all kinds of chemicals that you would not want to put in your mouth, so you can't help but wonder: Is it safe to coat a salad bowl or a serving platter with the stuff? The answer: Any commercial finish is safe, once it has dried *and* cured. Here's a look at the most common concerns.

Q Which finishes are safe for children's toys or projects that come in contact with food?

A You can use any finish that's appropriate to your project, including varnish, lacquer, shellac, and boiled linseed oil. Before putting it to use, be sure to allow for complete curing, a chemical process that takes significantly longer than drying. Some kinds of finish cure by evaporation of their solvent, and some cure by reacting with oxygen. Either way, the process continues after a film has formed on top.

Q How long does it take various finishes to cure?

A The container label should give you general guidelines about how long to wait. For example, one salad bowl finish recommends three days of curing after the final finishing step; one brushing lacquer calls for seven days of curing before normal use. But remember that temperature, humidity, and application thickness can stretch those rules. Just to be safe, add a couple of days to any recommendation before putting the finished item to use.

Q How about so-called salad bowl finishes? Are they any safer for use with food?

A We looked at the material safety data sheet (MSDS) for one type of salad bowl finish and found toluene—a probable cancer hazard—along with naphtha, ethyl benzene, and cobalt, all of which can damage your health with sufficient exposure. So, these products are as safe as, but no safer than, any other cured finish.

Q Are there any finishes that contain only natural substances?

A If you can't shake your concerns about finish coming in contact with food, rely on natural oils, such as mineral oil and walnut oil. Supermarkets carry mineral oil in the health products section; look for the more expensive walnut oil at a gourmet food shop or a health food store. They don't offer much protection to the wood, however, and you'll need to reapply oil after washing a wood object a couple of times.

Avoid vegetable oils. They can turn rancid, causing unpleasant odors or flavors in food touched by the wood.

Q Are there other substances that will protect cutting boards and butcher blocks?

A The U.S. Department of Agriculture's Forest Products Laboratory suggests melted paraffin wax. Apply as shown *below*. After it soaks into the wood and dries, scrape off any surface excess with a putty knife.

Photographs: **Marty Baldwin; Hetherington Photography**

To melt wax, fill the lower part of a double boiler with water, put paraffin in the upper unit, and set the heat on low.

Dealing with wood defects

There's no such thing as the perfect board. But you can salvage a lot of "challenged" lumber using these tricks.

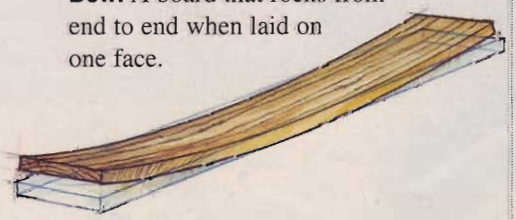
To put a straight edge on a crooked board, stick it on a long, straight carrier, such as a strip of plywood (about ¾×8×60"), using double-faced tape. Guide the carrier along the tablesaw fence to rip off one bad edge.

In woodworkers' dreams, all wood looks like the boards we see in cutting diagrams: flat and straight with parallel edges and not a single knot or inconsistency. In reality, though, wood is far from perfect. Even the best grades often suffer from one or more of the defects shown in these drawings.

The best way to deal with lumber defects is, of course, to avoid questionable boards in the first place. But if a board has great grain, is the only one available that suits your needs, or carries a bargain price, don't reject it just because of a few problems. Use the following tricks to get the most from less-than-perfect lumber.

DEFECT

Bow: A board that rocks from end to end when laid on one face.

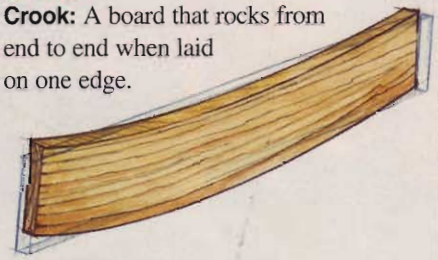


SOLUTION

Salvage a bowed board by crosscutting it into shorter sections, matching the lengths of pieces to the curve of the board. Use areas that are too bowed to produce flat stock to test setups or finishes. You may be able to create small parts, such as cleats or spacers, from the bowed pieces.

DEFECT

Crook: A board that rocks from end to end when laid on one edge.



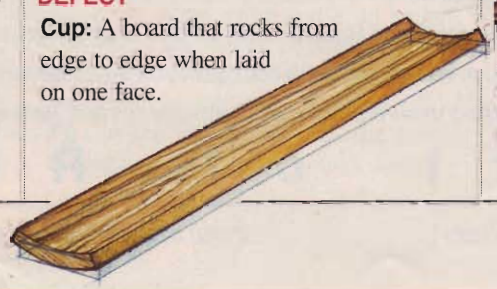
SOLUTION

How you straighten the edge of a crooked board depends on the severity of the defect. If the crook is mild, run the concave edge over your jointer to straighten it. Use caution to prevent the leading end from catching on the outfeed table.

For boards with severe crook, options exist. You can crosscut the board into shorter pieces, then joint each, as discussed above. You also can rip off the crooked edge at the tablesaw using a long carrier board, as shown in **Photo A**, *above*. Or snap a straight line on the board, cut it with a handheld circular saw, then joint the edge smooth.

DEFECT

Cup: A board that rocks from edge to edge when laid on one face.



SOLUTION

Rip a wide, cupped board into narrow flat sections, as shown in **Photo B**, *below*. Rip each piece slightly wider than you need, then rerip or joint the edges square to the face. You even can glue these sections back together to create a wide board.

Transform mildly cupped lumber into flat, thinner boards. First, joint the concave face flat, then plane the other face parallel.

Rip cupped boards with the convex face against the saw table. A scrap clamped to the fence guides the workpiece and holds the portion being cut flat against the table.

Continued on page 28

Circle No. 1870

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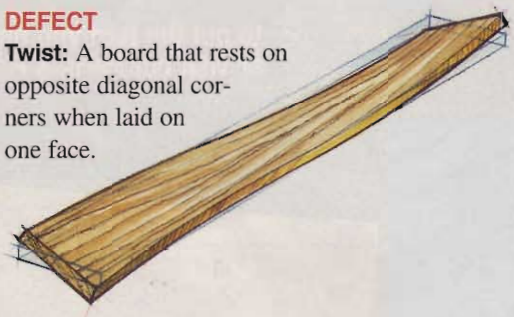
Circle No. 180

DEFECT

Twist: A board that rests on opposite diagonal corners when laid on one face.



SOLUTION

A severely twisted board is difficult to save. You may salvage short pieces, though, by using a combination of the methods previously described.

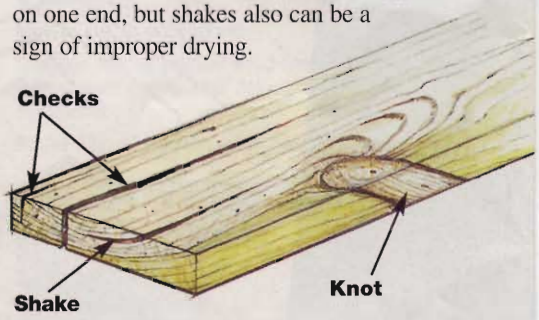
DEFECTS

Checks and shakes: Checks are cracks across the growth rings. Shakes are cracks between the rings.

SOLUTION

These cracks occur at the ends of boards, so you may simply cut off the bad areas. But don't be too hasty. Good narrow pieces often exist on either side of a check.

Shakes, because of their orientation, usually have to be cut off. Be leery of boards with excessive shake. This may be a result of the board simply being dropped on one end, but shakes also can be a sign of improper drying.



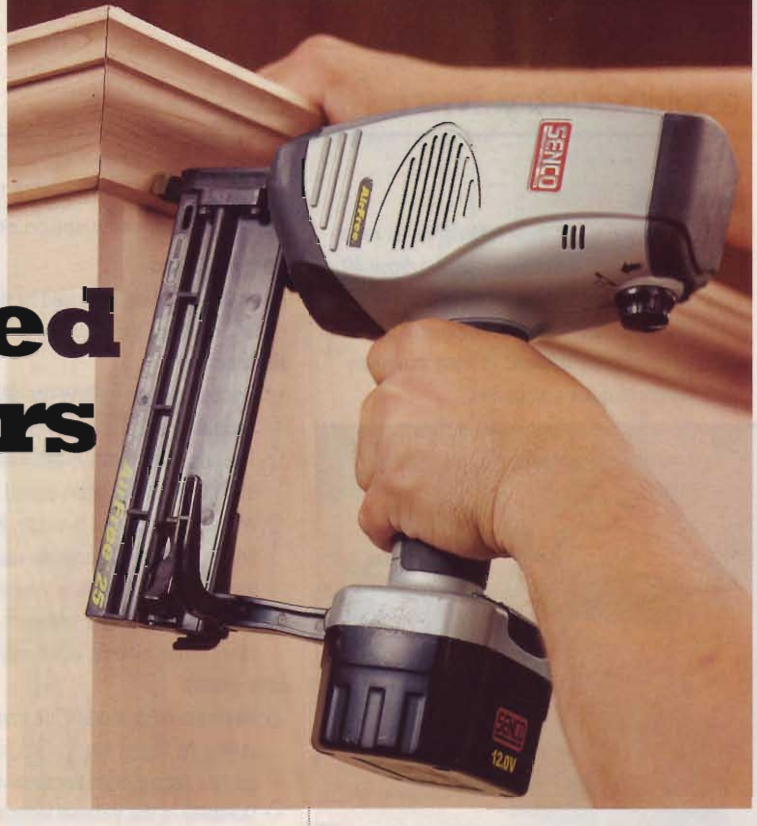
DEFECTS

Knots: These are remnants of branches.

SOLUTION

If they're tightly held in the wood, knots usually pose just appearance problems. Use these boards in inconspicuous places where the knots won't show. Loose knots, on the other hand, may fall out or be pulled free by cutting bits and blades. Cut out and discard areas with loose knots.

Written by **David Stone**
Illustrations: **Mike Mittermeier**
Photographs: **Marty Baldwin**



battery-fired brad nailers

Look, Ma, no hose! But are these tetherless tools worth the weight?

Over the past year or so, three manufacturers (Paslode, Porter-Cable, and Senco) have unleashed 18-gauge brad nailers that require neither an air compressor nor an electrical outlet. Their power source: a rechargeable battery pack and/or a fuel cell.

After extensively testing all three models, we found that these tools deliver on their promise of power, mobility, and convenience. We certainly don't miss dragging out the air hose to tack banding on the edge of a shelf or cap a cabinet with crown molding.

Convenience has its price, though. You'll pay as much for one of these nailers as you might for a similar pneumatic model *and* a small compressor. And these 5- to 7-pound machines weigh from two to three times as much as their air-driven counterparts (weighing 2½–3½ lbs.).

Although the three tools use different methods to generate the driving force, each nailer proved reliable, easily punching ⅝–2" brads into 2"-thick maple. And, none jammed during our tests.

How the three nailers performed in our tests

Paslode IM200-F18, $380

800/662-3428, www.paslode.com

How it works:

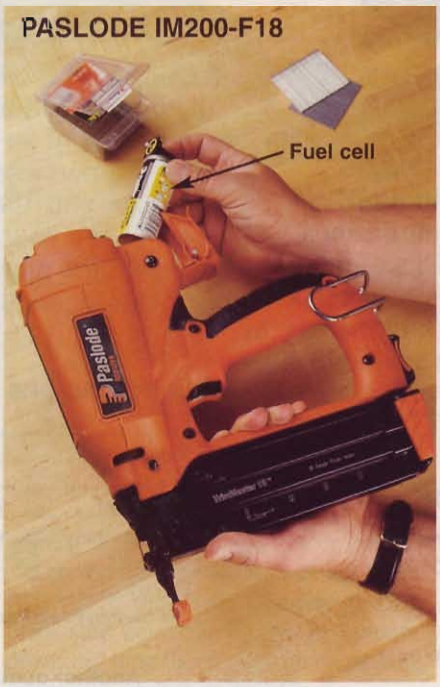
Like the engine in your car, the battery creates a spark that ignites fuel in the cylinder, powering the piston, driver, and the brad.

High points

- ⇧ At 5 lbs., it's the lightest in the test.
- ⇧ This technology has been proven in Paslode's larger airless nailers.
- ⇧ Drives brads as fast as you can pull the trigger.

Low points

- ⇩ Highest initial cost. Disposable fuel cells will set you back about $8 per cell. Each cell is good for about 1,000 fasteners, and has a shelf life of about 18 months.
- ⇩ Foul exhaust smell.
- ⇩ Regular maintenance, including partial disassembly of tool, is important.
- ⇩ Only one 6-volt battery comes with the nailer, it takes two hours to fully charge, and it will discharge if left in the tool.



Porter-Cable BN200V12, $270

800/487-8665, www.porter-cable.com

How it works:

The 12-volt, NiCd battery powers a small onboard compressor that refills the air reservoir after every fastener is driven.

High points

- ⇧ Besides battery power, the nailer also has an air fitting so it can be used as a conventional pneumatic nailer.
- ⇧ It's the least expensive model in the test.
- ⇧ Quick-release nosepiece makes clearing jammed fasteners simple and fast.

Low points

- ⇩ It's heavy (7 lbs.) and tail-heavy, at that.
- ⇩ Comes with only one battery; and it will discharge if accidentally stored without shutting off power.
- ⇩ Noisy onboard compressor runs for 2–3 seconds after each fastener is fired.
- ⇩ Won't drive a fastener unless trigger is pulled within 3 seconds of depressing safety tip.
- ⇩ No "empty magazine" indicator.

Continued on page 30

More points

- Although you might think refilling the air reservoir would slow the driving rate, we drove 40 2" brads, pulling the trigger as fast as we could, before the onboard compressor couldn't keep up with the demand of firing that many fasteners in quick succession.

Senco AirFree 25, $319

800/543-4596, www.senco.com

How it works:

An internal flywheel, powered by the 12-volt NiCd battery, develops the power to drive the fastener.

High points

- Electronic depth-setting dial allows you to accurately set driving depth.
- The price includes two batteries, which don't discharge quickly when stored in the tool.
- When the magazine is empty, the nailer won't fire. ("Dry firing" needlessly wears the tool, and leaves empty dimples in your workpiece.)
- Drives slightly longer fasteners (2⅛") than the other tested models, which max out at 2".

Low points

- While the other models fire immediately upon pulling the trigger, the flywheel in this nailer winds up for a second or so before driving the fastener.
- Durability of this flywheel technology is untested.

More points

- Hexhead wrench required to clear jams, but the wrench stores on the tool.

Which one would we have in our shop?

Although it doesn't rapid-fire fasteners like the Paslode or Porter-Cable nailers, the Senco AirFree 25 proved plenty fast for woodworking tasks, where accurate fastener placement is more important than lightning speed. We also liked its many features, such as the dry-fire lockout and electronic depth setting.

Written by **Dave Campbell** with **Dave Fish**

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palmetto

an unsung war hero

Cabbage palmetto derives its name from the taste of its leaf buds.

Around the world, the palm tree family numbers more than 2,000 species. Most of them grow in tropical lands and are best known for the products they yield, such as oil, nuts, dates, and sugar, rather than their odd wood. Its non-grainy compaction of very hard fibers is not like wood at all.

The cabbage palmetto (*Sabal palmetto*) of South Carolina and Florida is a palm, also, but a far cry from its graceful tropical cousins. Cabbage palmetto is rather small and plain, barely reaching 50' tall and a 24" diameter. Nevertheless, the tree contributed mightily to our history.

When General William Moultrie defended Charleston Harbor against the British fleet on June 28, 1776, he and his patriot army of South Carolinians were protected by a stockade built of cabbage palm logs. Today, that occasion is commemorated on the state seal of South Carolina, prominently embellished with the image of a cabbage palm.

Beyond its historical value, the cabbage palm does have some commercial value. Its main claim to fame is the tender leaf bud at the top of the trunk that, when cooked, takes on a cabbage-like flavor. You'll find it canned and labeled "heart of palm" in some supermarkets. The tree's wood has little value, though, except as fence posts and poles. And cross sections of cabbage palm are occasionally worked into lustrous tabletops for the tourist trade.

Some other palm species, such as Southeast Asia's sugar palm, exhibit greater versatility. Its trunk is tapped and the liquid boiled down to a tasty sugar. When harvested young, its fruit provides sustenance, too. The outer portions of the sugar palm's trunk are made into tool handles. Other fibrous parts become rope.

Written by **Peter J. Stephano**
Illustration: **Brian Jensen**

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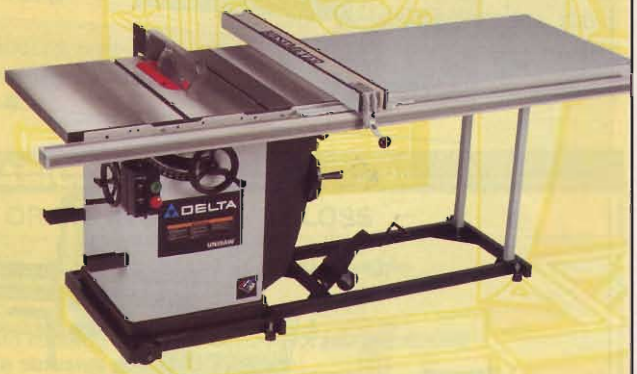

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shop tips

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Set your circle cutter without calculating

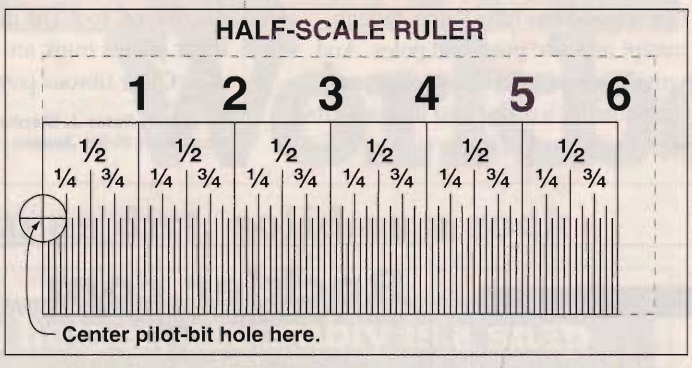
I used to dread using my adjustable circle cutter: I had to figure the radius of the circle (halving odd diameters like 3 7/16" brought out the calculator), then fuss with a ruler, the pilot bit, and cutter to set that radius. It was a pain in the neck and required a lot of tweaking.

To eliminate the headaches, I devised the simple fixture, shown *below*, with a half-scale ruler built right in. After drawing the half-scale on my CAD system, I printed it (you can use the full-size pattern at *right*) and had it laminated at an office-supply store.

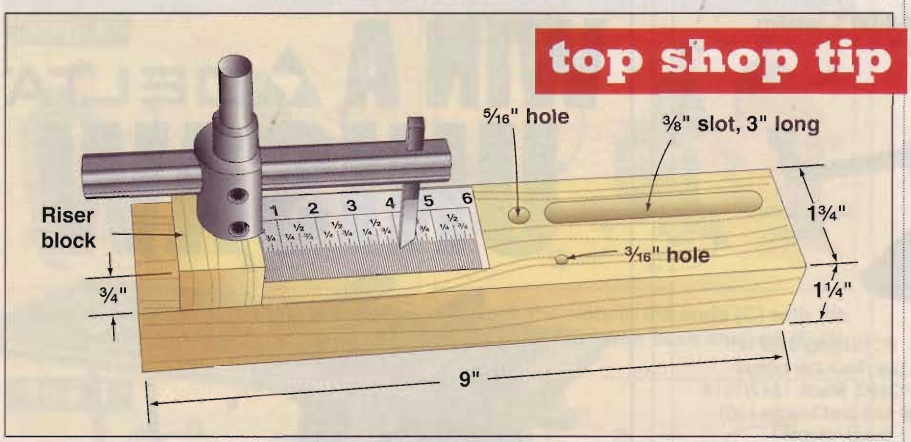
Then, I attached it to the jig with double-faced tape.

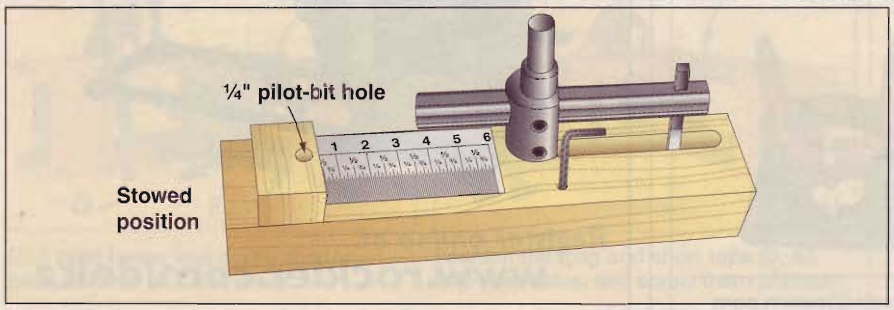
If I need a 3 7/16" circle, I simply insert the pilot bit into the 1/4" hole in the riser block, extend the cutter to the 3 7/16 mark on the half-scale, and lock it in. When I'm done, the cutter and its hexhead wrench store in the jig as shown.

—Bob DiTucci, Wayne, N.J.



top shop tip





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our winner

As manufacturing manager for a clutch and brake factory in New Jersey, Bob DiTucci is charged with improving productivity. So when he sees a repetitive task in the plant, he calls on his 20-plus years of woodworking and production experience to fashion a jig or fixture that makes the job more efficient.

And, our Top Shop Tip winner is equally resourceful when choosing materials for his projects. "I salvaged a load of beautiful 1 1/4"-thick maple that used to be benches in the company locker room," Bob said. "I turned them into a rocking horse [shown *above*] for my 4-year-old daughter."

For sending this issue's Top Shop Tip, Bob DiTucci receives a Fein RT1800 plunge router. We know that you'll put it to good use, Bob!

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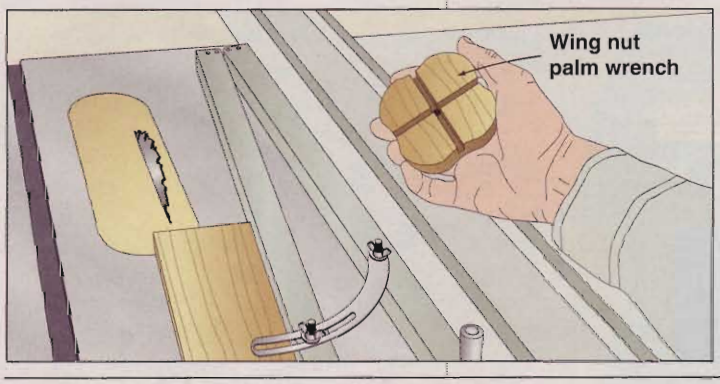
Because we try to publish only original tips, please send your tips only to *WOOD* magazine. Sorry, but we can't return your materials.

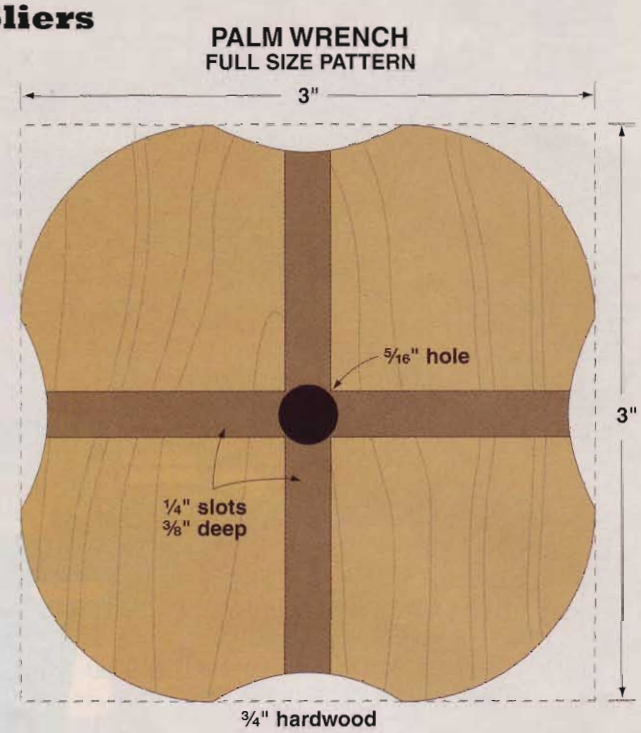
Tough wing nut? Put away those pliers

Many jigs and fixtures have wing nuts for making adjustments without wrenches. But in my efforts to keep them secure, I often tighten them to the point where I can't loosen them. And over the years, I've broken a lot of wings off using pliers.

So I designed the "palm wrench," shown at *right*, to give me more leverage. I slip the wrench over a stubborn wing nut or thumbscrew, rotate it until the wings catch in the grooves, and break the rascal loose. The center hole accommodates a bolt that may protrude through the wing nut and also makes a handy hole for hanging the palm wrench on perforated hardboard.

—Manny Davis, Sherman Oaks, Calif.





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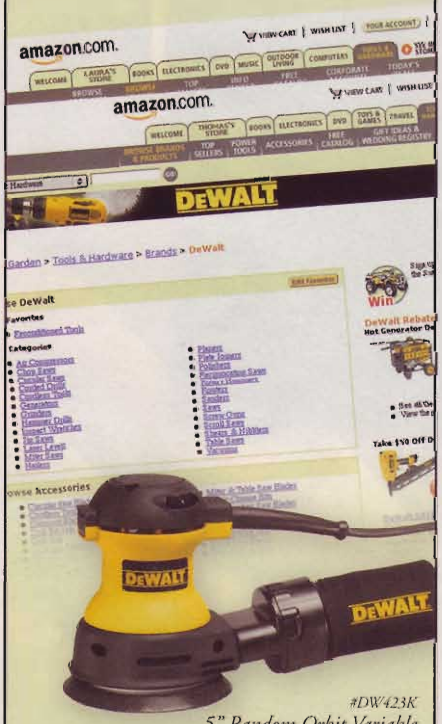

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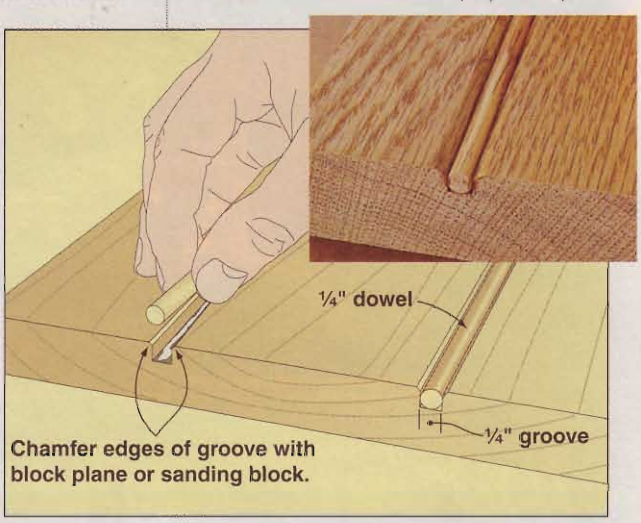
Put a bead in any board

While building a cabinet recently, I decided I wanted a beaded-board look on the doors, but didn't want to hassle with beading a solid-wood panel. (Router bits designed for this task don't work in the middle of a panel.)

So, using a dado set on my tablesaw, I made my own by cutting ¼" grooves where I wanted the beads. After breaking the edges of each groove, I glued a ¼" dowel into each groove. The end result: It looks just like the real McCoy. Try using this technique with a contrasting species of dowel for visual effect.

—Robert Holzer, Jr., Phoenix, Ariz.

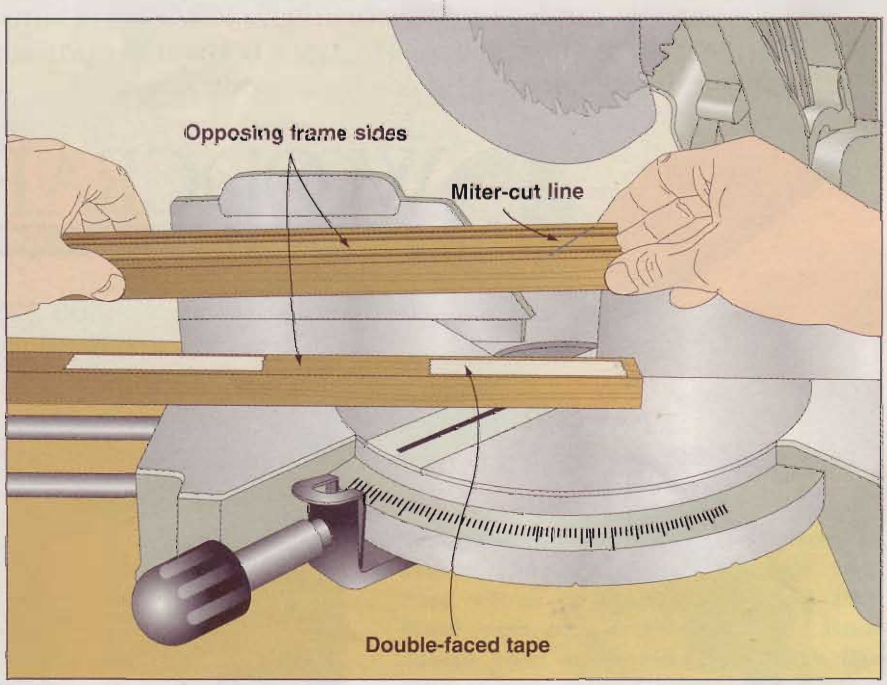


Simple idea for picture-perfect frames

After reading up on the subject, I recently made my first picture frame out of moldings. Everything I read said to make sure that the opposite sides of the frame were the exact same length, but after trimming, tweaking, and shaving the workpieces to make them identical, I thought I'd go nuts!

Then it hit me: Cut two pieces at the same time, and they have to be the same length. I double-face taped the opposing frame sides back-to-back and mitered both ends of both pieces with only two cuts. The joints came out absolutely perfect.

—Jim Culler, Bellville, Ohio



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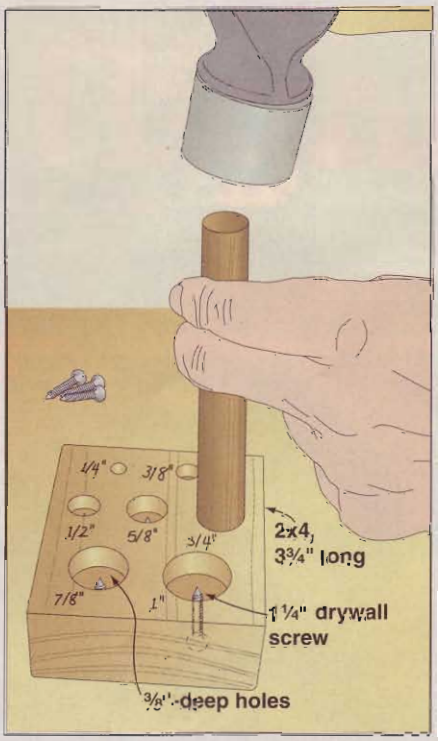
Circle No. 1876

Dowel sizer does double duty

I can't quickly tell the diameter of a dowel at a glance, so I made a dowel-sizing gauge, shown *below*, using various Forstner bits. By inserting the end of a dowel into the gauge, I can find its diameter.

To make the gauge even more useful, I added a center-finding function to it. The Forstner bit leaves a nice dimple in the center of each hole, and I drilled a 1/16" pilot hole through each dimple and all the way through the gauge. A 1¼" drywall screw, driven in from the bottom of the gauge, leaves a small point protruding. To mark the center of a dowel, I insert it into the gauge and tap the end with a hammer to give me a perfectly centered mark.

—Wendell Hughes, Elk Horn, Ky.



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Circle No. 800

Looking for a place to perch while you remove street shoes and ease into slippers? Here's a down-home bench that's as good-looking as it is practical. And its style matches the coat-rack on *page 48*.

sit-a-spell

hall bench

Made of sturdy red oak enhanced by a medium-toned stain, this bench fits right into your come-and-go lifestyle, and your limited shop time. Our design combines straightforward stub-tenon-and-groove end assemblies with screw-and-plug joinery to give you a substantial piece of furniture that's easy to build. An open shelf stores footwear out of an entry's traffic lane and allows plenty of air circulation for drying damp shoes.

For the items needed to build this project, see the Materials List and Cutting Diagram on *page 47*.

Start with the end parts

1 Cut the panels (A) to the size shown on the Materials List. Because the ¼" plywood panels are visible from both sides, we applied oak veneer to their backs. See the sidebar on *page 44*, for information on veneering the backs of your panels.

2 Cut the rear uprights (B), front uprights (C), upper rails (D), and lower rails (E) to size.

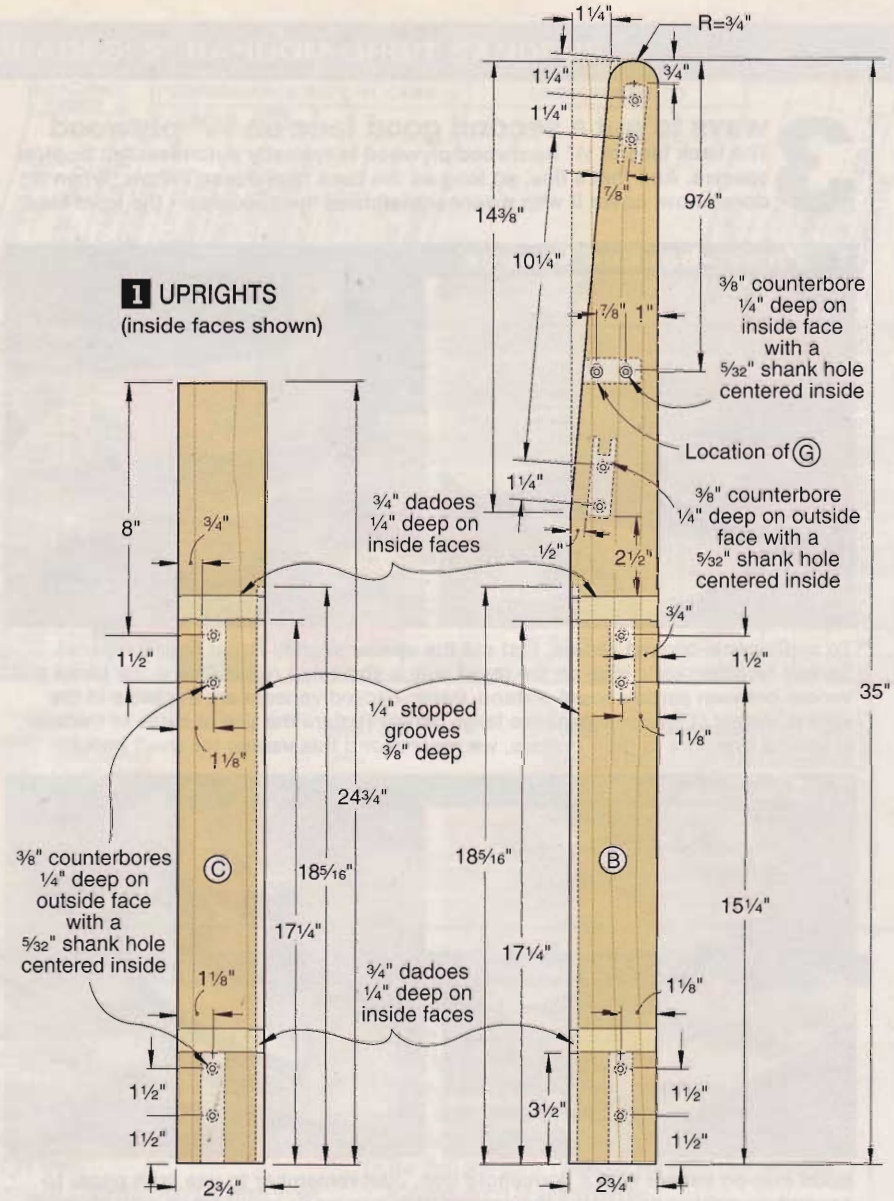
3 Install a ¼" straight bit in your table-mounted router, and adjust it to cut ⅜" deep. Position the fence to make a centered groove in parts B, C, D, and E. Mark the bit's position on a piece of masking tape adhered to the router-table insert. Mark the ends of the stopped grooves on the sides of the uprights (B, C), where shown on **Drawing 1**. Rout the grooves, stopping when the mark on the side of the upright aligns with the bit's marked position on the tape.

***Note:** With their backs veneered, our panels (A) fit nicely in a ¼" groove. Check the fit of your panels in the uprights' grooves before proceeding.*

4 Without changing your router-table setup, rout the grooves in the upper rails (D) and lower rails (E), where shown on **Drawing 2**. Set the rails aside.

5 Mark the angled cut and the top radius on each of the rear uprights (B), where shown on **Drawing 1**. Bandsaw the angle on each upright just outside the marked lines, and then sand or joint them smooth. Bandsaw and sand the top radii.

6 Mark the locations of the counterbored holes on the rear and front



***Note:** Use the same double-curved profile for the shelf skirts (H).*

3 ways to put a second good face on ¼" plywood

The back face of ¼" hardwood plywood is typically a nondescript tropical species. And that's fine, so long as the back face doesn't show. When it does show, cover it with a veneer matching the species on the front face.

1. Paper-backed Veneer

To apply paper-backed veneer, first cut the veneer slightly larger than the panel. Spread woodworker's glue on the panel with a short-nap roller. Clamp the panel and veneer between particleboard platens. Paper-backed veneers are available in the widest variety of species. Because large panels require the use of cauls to transfer clamping pressure to their centers, we recommend this veneer for small panels.

2. Iron-on Veneer

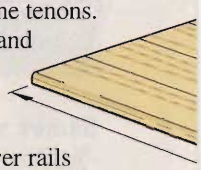
Bond iron-on veneer with a household iron. Just remember to use kraft paper to prevent scorching or marring the veneer. Use a roller or wood block with rounded edges to smooth the veneer as the adhesive cools. Although more expensive than paper-backed veneer, we chose iron-on veneer for the hall bench because it's easy to apply and was available at our local home center. Species selection is limited.

3. Peel-and-stick Veneer

To adhere peel-and-stick veneer, pull back its release paper about ¼" along the sheet's longest edge, exposing the adhesive. Apply this edge to the panel's mating edge. Press the veneer in place with your hand as you continue removing the release paper. Smooth the veneer with a roller or wood block. This is the ultimate no-fuss method, but also the most expensive. Species selection is limited.

uprights (B, C), and drill them on your drill press. Be sure to drill the counterbores so you have mirrored pairs of uprights. Note that all the counterbores are on the parts' *outside* faces, except those for the screws that fasten the arms (G). Drill these counterbores on the parts' *inside* faces.

7 To form the tenons on the rails (D, E), cut ⅜" rabbets ¼" deep on their ends. Make test cuts in scrap the same thickness as the rails, and test the tenon's fit in the grooves of the uprights (B, C). Make any necessary adjustments to achieve a snug fit, then cut all the tenons. Raise the dado blade to ⅜", and cut the shoulders on the tenons of the upper rails (D), as shown in **Photo A**.



8 Draw the cutouts in the lower rails (E), where shown on **Drawing 2**. Bandsaw and sand the cutouts.

9 Cut two ¾×2¾×4½" blanks for the brackets (F) and two ¾×4½×15¾" blanks for the arms (G). Make two copies each of the bracket and arm patterns on the *WOOD PATTERNS*® insert. Adhere the patterns to the blanks with spray adhesive. Bandsaw and sand the parts to the pattern lines.

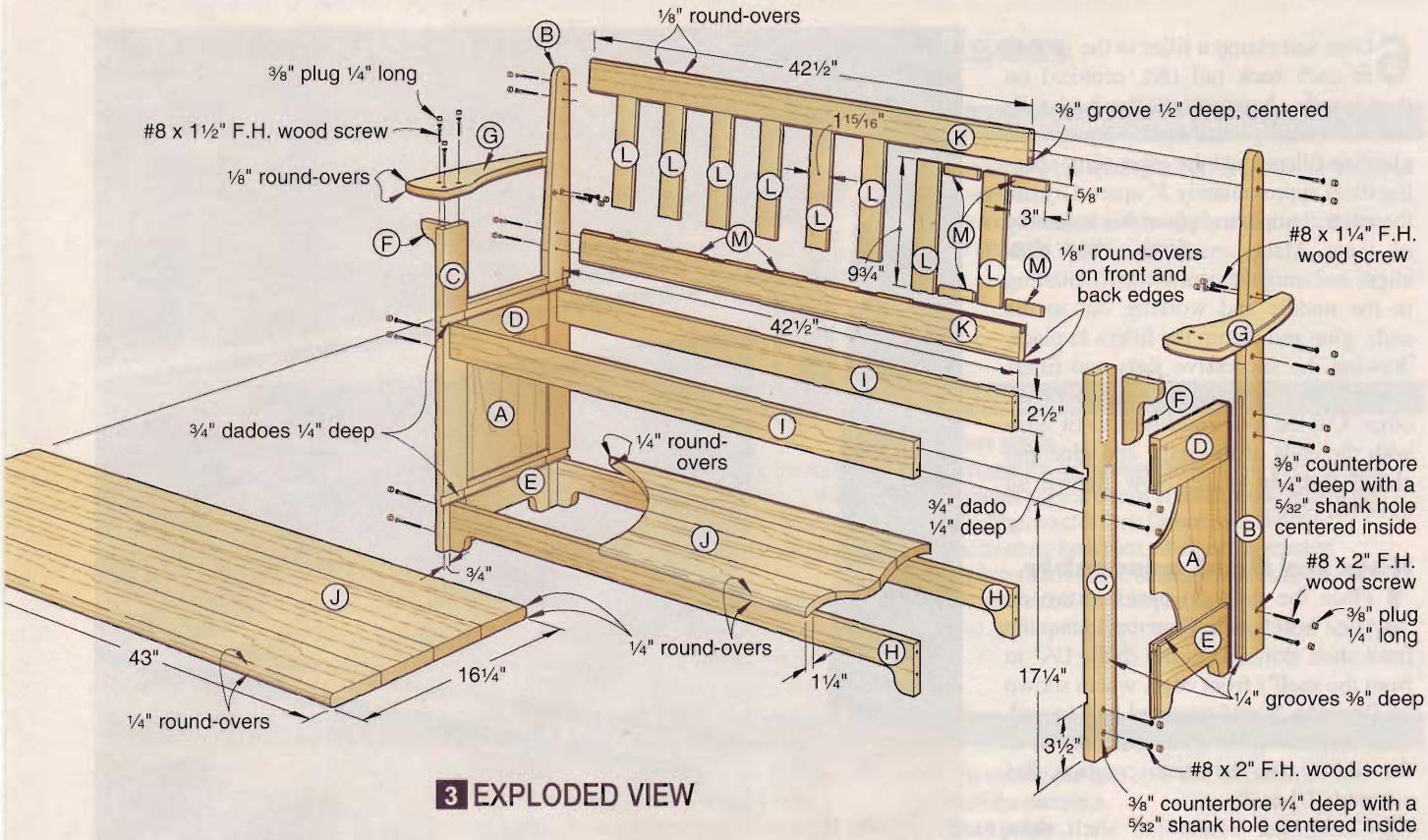
10 To make a mirrored pair of arms, transfer the hole locations on one arm to the face opposite the pattern by drilling 1/16" holes through the arm. Drill the counterbores in both arms. Then drill the centered 5/32" holes in one arm and enlarge the 1/16" holes to 5/32" in the other.

11 Install a ⅛" round-over bit in your table-mounted router, and round over the edges of the arms, where indicated on the pattern.

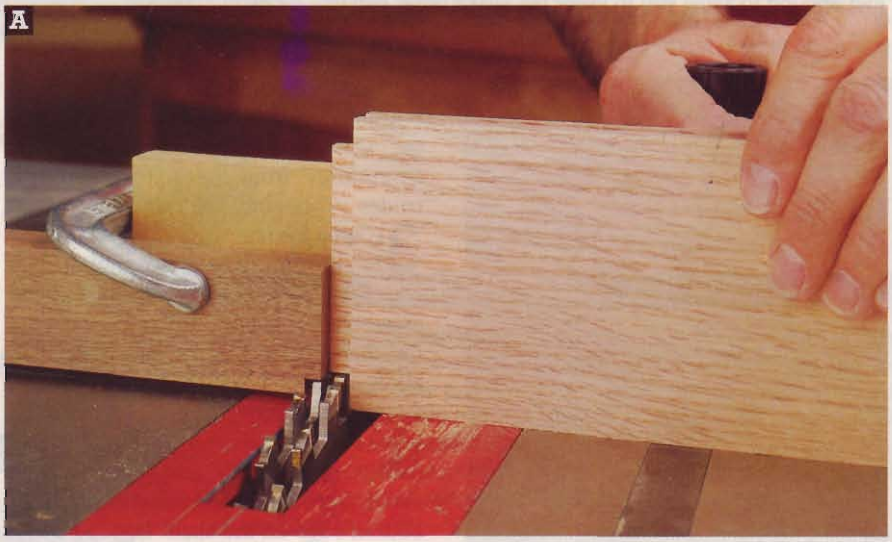
Assemble the ends

1 Before applying glue, dry-assemble the panels (A), uprights (B, C), and rails (D, E) to make sure everything fits. Orient the best faces of the panels outward. The stopped grooves in the uprights are slightly long, so keep the panels bottomed in the rails' grooves, and align the lower rails (E) with the bottoms of the uprights. When satisfied with the fit, glue and clamp the end assemblies.

2 With the glue dry, cut ¾" dadoes ¼" deep across the inside faces of the end assemblies, where dimensioned on **Drawing 3**. To prevent tear-out, back your cuts with a follower block. Once again, make certain your assemblies are mirrored pairs.



3 EXPLODED VIEW



Attach an auxiliary extension to your miter gauge. Position the upper rail on its edge, with its groove facing up. Clamp a stopblock to the extension, and cut the tenon shoulders.

3 Glue and clamp the brackets (F) to the outside faces of the front uprights (C), centered on their width, where shown on **Drawing 3**.

4 Clamp the arms (G) in place. Using the holes in the rear uprights (B) and the arms as guides, drill pilot holes into the arms, front uprights, and brackets, and drive in the screws.

5 Chuck a ⅜" plug cutter in your drill press, and make at least 34 plugs ⅜" long, enough for all the counterbores in the entire project. Glue plugs into the counterbores for the screws that fasten the arms in place, and sand them smooth. Set the rest of the plugs aside. Sand the end assemblies to 220 grit. See the shop tip, *page 46*, for tips on hiding plugs.

Build the shelf, seat, and back

1 Cut the shelf skirts (H) and seat skirts (I) to the sizes listed. Lay out the same double-curved profile shown for the lower rail (E) on **Drawing 2** on the ends of the shelf skirts. Bandsaw and sand to the layout lines.

2 Edge-join oversize blanks for the seat and shelf (J). With the glue dry, trim them to finished size. Install a ¼" round-over bit in your handheld router, and rout the edges of the seat and shelf, where shown on **Drawing 3.**

3 Cut the back rails (K) to the size listed. Install a ⅜" dado blade in your tablesaw and cut ½"-deep grooves, centered on the thickness of each rail, where shown. Rout ⅛" round-overs on the edges opposite the grooves.

4 Plane enough stock to ⅜" thick for the slats (L) and fillers (M), checking their fit in the back rails' grooves. Cut the slats and 14 fillers to size. Cut the remaining four fillers ½" longer than listed. They are cut to length during assembly.

5 Sand all the parts H, I, J, K, L, and M to 220 grit. For easy insertion later, ease the edges of the fillers (M) with a sanding block.

6 Glue and clamp a filler in the groove in each back rail (K), centered on their lengths. Assemble the two back rails with two slats pushed tightly against the glued-in fillers. Add the other slats, spacing them approximately 3" apart. Lay out three bar clamps, and place this assembly on them. Make certain the rails' ends align, and snug the center clamp. Starting in the middle and working out to the ends, glue and clamp the fillers in place, drawing the successive slats and fillers toward the center and tight against each other. Cut the four end fillers to fit flush with the ends of the rails, and glue and clamp them in place. Now tighten all three bar clamps.

Now for final assembly

1 Place the shelf (J) upside down on your workbench. Glue and clamp the front shelf skirt (H) to the shelf, 1¼" in from the shelf's front edge, where shown on **Drawing 3,** and centered end to end. Glue and clamp the front seat skirt (I) to the seat (J) in the same position. Set assembly I/J aside.

2 Clamp the assembled shelf skirt and shelf (H/J) between the end assemblies with bar clamps, seating the shelf's ends in the end assemblies' bottom dadoes. Position the shelf so the skirt is ¾" back from the end assemblies' front edges. The shelf protrudes ½" beyond the front uprights.

With one end of the seat assembly resting on a spacer, flex the opposite side assembly just enough to allow you to lower the seat's other end into its dado.

3 Clamp the rear shelf skirt (H) in place ¾" in from the end assemblies' rear edges. Using the shank holes in the end assemblies as guides, drill pilot holes into the shelf skirts. Drive in the screws. To allow for wood movement, do not glue the rear skirt to the shelf.

4 Retrieve the seat assembly (I/J). Clamp a 13×13" scrap spacer to the inside face of one end assembly with its bottom edge on the shelf. Its top edge is even with the bottom of the end's top dado. Now, insert the seat assembly, as shown in **Photo B**. Align the seat the same as you did the shelf.

5 Clamp the rear seat skirt (I) in place ¾" in from the end assemblies' rear edges. Using the shank holes in the end assemblies as guides, drill pilot holes into the seat skirts. Drive in the screws. Do not glue the rear skirt to the seat.

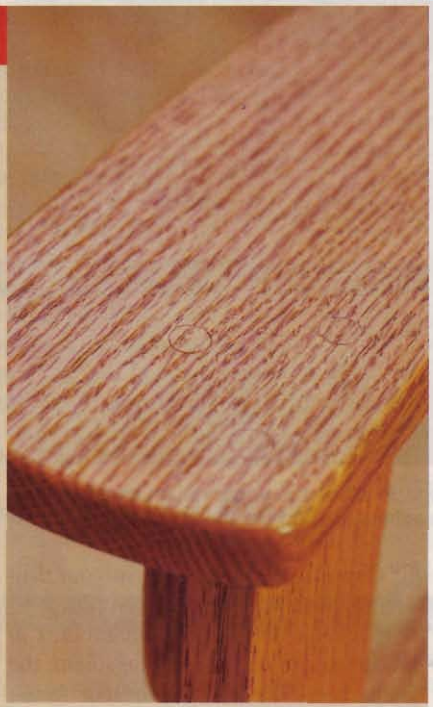
6 Rest the back assembly (K/L/M) on 2½×2½" spacers clamped to the rear

SHOP TIP

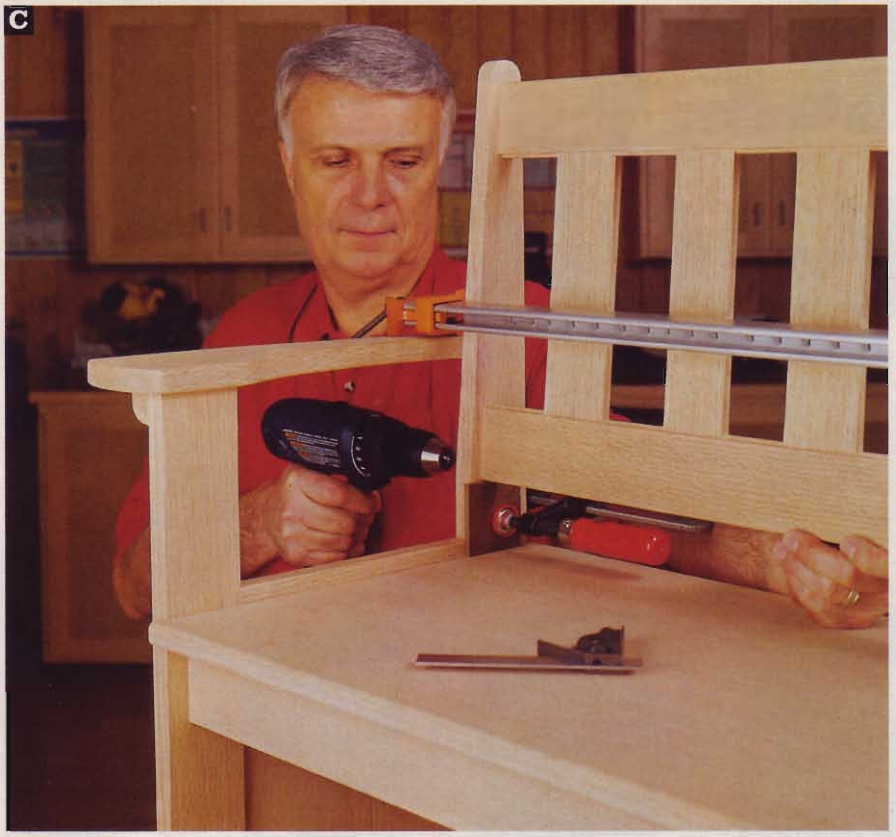
Achieving the (almost) invisible plug

When developing the design for this project, we were concerned that the end assemblies and arms with all their plugged counterbores might look like Swiss cheese. To prevent that, project builder Chuck Hedlund took great care in selecting and installing the plugs, shown in the photo. Here are some of Chuck's tips:

- Drill your counterbores with a sharp brad-point or Forstner bit. Whenever possible, use your drill press.
- Save cutoffs from the parts that need plugs. Cut the plugs from these pieces.
- Use tapered plug cutters. With these your plugs will fit tightly, like corks in bottles.
- Cut more plugs than you need. This allows you to select plugs that best match the wood grain pattern and color around the counterbore.



• When installing the plugs, take care to align the plug's grain with that of the surrounding wood.



Rest the back assembly on 2½"-wide spacers, and clamp it in place. Using the shank holes in the rear uprights as guides, drill pilot holes, and drive in the screws.

uprights, and fasten it in place, as shown in **Photo C**. The back assembly's rails are set ½" back from the angled edge of the rear uprights (B), where shown on **Drawing 1.**

7 Retrieve the previously made plugs, and glue them into the remaining counterbores. Sand the plugs flush.

On to the finish

1 Check all surfaces of the bench and resand areas that need it. Ease any sharp edges with a sanding block and 220-grit sandpaper.

2 If you wish, apply a stain. We used ZAR Salem Maple, following the directions on the can. Let the stain dry for 24 hours. Apply a clear finish. We brushed on two coats of satin polyurethane, sanding between coats with 220-grit sandpaper.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**
Photographs: **Marty Baldwin**

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A panels	¼"	10½"	10¾"	OP	2
B rear uprights	¾"	2¾"	35"	O	2
C front uprights	¾"	2¾"	24¾"	O	2
D upper rails	¾"	3¾"	10½"	O	2
E lower rails	¾"	4¾"	10½"	O	2
F* brackets	¾"	2½"	4¼"	O	2
G* arms	¾"	4¼"	15½"	O	2
H shelf skirts	¾"	3½"	42½"	O	2
I seat skirts	¾"	2½"	42½"	O	2
J* seat and shelf	¾"	16¼"	43"	EO	2
K back rails	¾"	2½"	42½"	O	2
L slats	⅜"	1 15/16"	9¾"	O	8
M* fillers	⅜"	⅝"	3"	O	18

*Parts initially cut oversize. See the instructions.

Materials Key: OP–oak plywood, O–oak, EO–edge-joined oak.

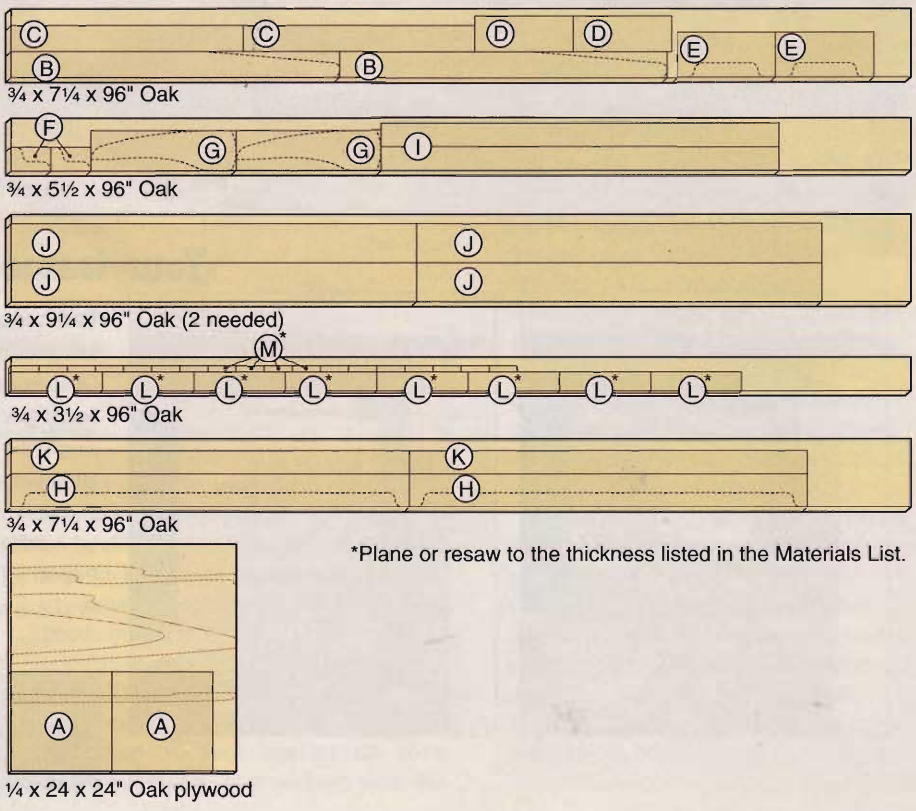
Supplies: #8×1¼" flathead wood screws (4), #8×1½" flathead wood screws (6), #8×2" flathead wood screws (24), spray adhesive.

Blades and bits: Stack dado set; ⅜" plug cutter; ¼" straight, ⅛" and ¼" round-over router bits.

Buying Guide

Veneer. Flat-cut red oak veneer, 2×8' paper-backed no. H4028, $19.95, or 2×8' peel-and-stick no. H4029, $39.95. Also available in 4×8' sheets and 19 different species. Call Grizzly Industrial at 800/523-4777, or go to www.grizzly.com. Look for iron-on veneer at your local home center or woodworking specialty store.

cutting diagram



*Plane or resaw to the thickness listed in the Materials List.

country coatrack

Add zest and function to your home with this "entry"-level project. And while providing family members and guests a place to hang their coats, take the opportunity to show off your favorite 5×7" photos at the same time. You can place other items in the frames, too. See *below* for some ideas.

Your frame-filling options

Feel free to customize the look and functionality of the coatrack frames. Options include photographs and chalkboard (photo *above*), corkboard, or simply the plywood frame backs as attractive wood fillers (photos at *left*). To make your own chalkboard, spray ¼" hardboard with Rust-Oleum Painter's Touch Chalk Board Finish, available at home centers.

For the items needed to build this project, see the Materials List and Cutting Diagram on *page 50*.

Fashion a sturdy frame

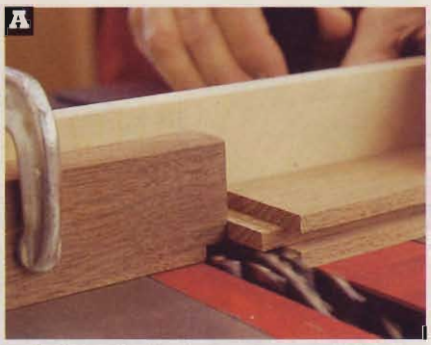
1 Cut the top rail (A), bottom rail (B), mullions (C), and shelf (E) to the sizes listed in the Materials List. Cut the stiles (D) ½" longer than the size listed. You'll cut these to final length later.

2 Using a dado blade in your tablesaw, cut ¼" grooves ⅜" deep, centered in the top rail, bottom rail, mullions, and stiles, where dimensioned on **Drawings 1** and **2**. To make sure that each groove is centered in the part, turn the piece end-for-end after the first pass and make a second pass. Don't worry about making the groove a bit wider. You'll simply compensate by making the tenons slightly thicker to fit snugly in the grooves.

3 Using the setup as shown in **Photo A**, cut a ⅜"-long test tenon on a piece of scrap the same thickness as your parts. Check the fit of the tenon in one of the grooves. Trim as needed until you get a snug fit. Then, cut the tenons on the ends of the rails (A, B) and mullions (C).

4 Mark the locations of the mullions (C) on the top and bottom rails (A, B), where dimensioned on **Drawing 1**. Dry-assemble the rails and mullions, and check for correct fit. Then, glue and clamp the pieces together.

5 Measure the distance between the outer edges of the top and bottom rails. Then, trim the stiles (D) to your measurement. Now, glue and clamp the stiles flush against the rails.



A stopblock clamped to an auxiliary extension makes it easy to form a ⅜"-long tenon on the ends of the rails and mullions.

Machine the details

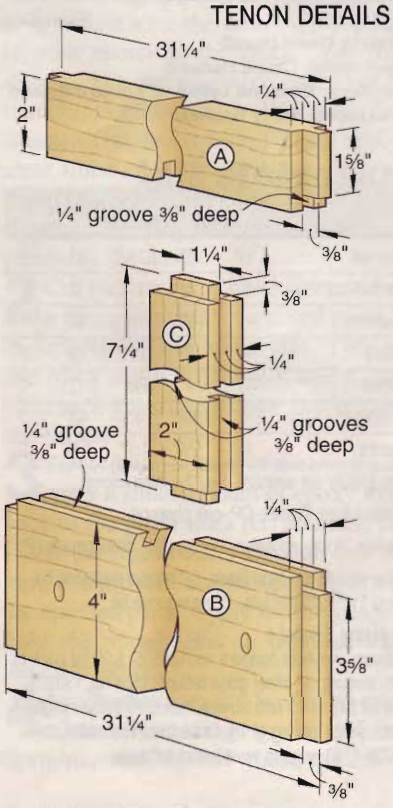
1 Rout a ⅜" rabbet ½" deep around each of the openings on the back side of the frame assembly, where shown on **Drawing 3**. To avoid chip-out, refer to the **Shop Tip**, *below*. Using a chisel, square the corners of the rabbet in each opening.

2 Using a 1½" Forstner bit, drill 5/16"-deep holes for the glass retainer clips, where shown. Then, drill a 3/32" pilot hole 7/16" deep in the center of each hole for the retainer-clip screw.

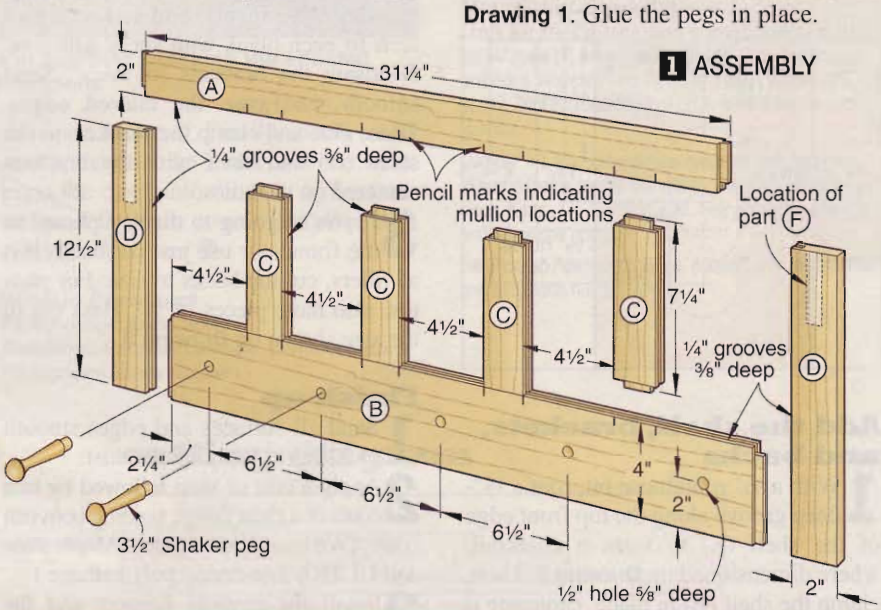
3 Mark the locations for drilling four ⅝" holes on the back of the stiles (D), where dimensioned on **Drawing 3a**, to form slots to receive the keyhole hangers. Chuck a ⅝" Forstner bit in your drill press, and drill the outer holes ⅛" deep, and drill the inner holes ⅜" deep. (The deeper holes provide space to receive the head of a wall-hanging screw.) Straighten the sides of the slots with a chisel. Place a keyhole hanger in each slot. Then, mark and drill 3/32" pilot holes ⅝" deep (measured from the back surface of the stiles) for the mounting screws.

4 Drill ½" holes ⅝" deep on the face of the bottom rail (B) to receive the Shaker pegs, where dimensioned on **Drawing 1**. Glue the pegs in place.

2 GROOVE-AND-TENON DETAILS



1 ASSEMBLY

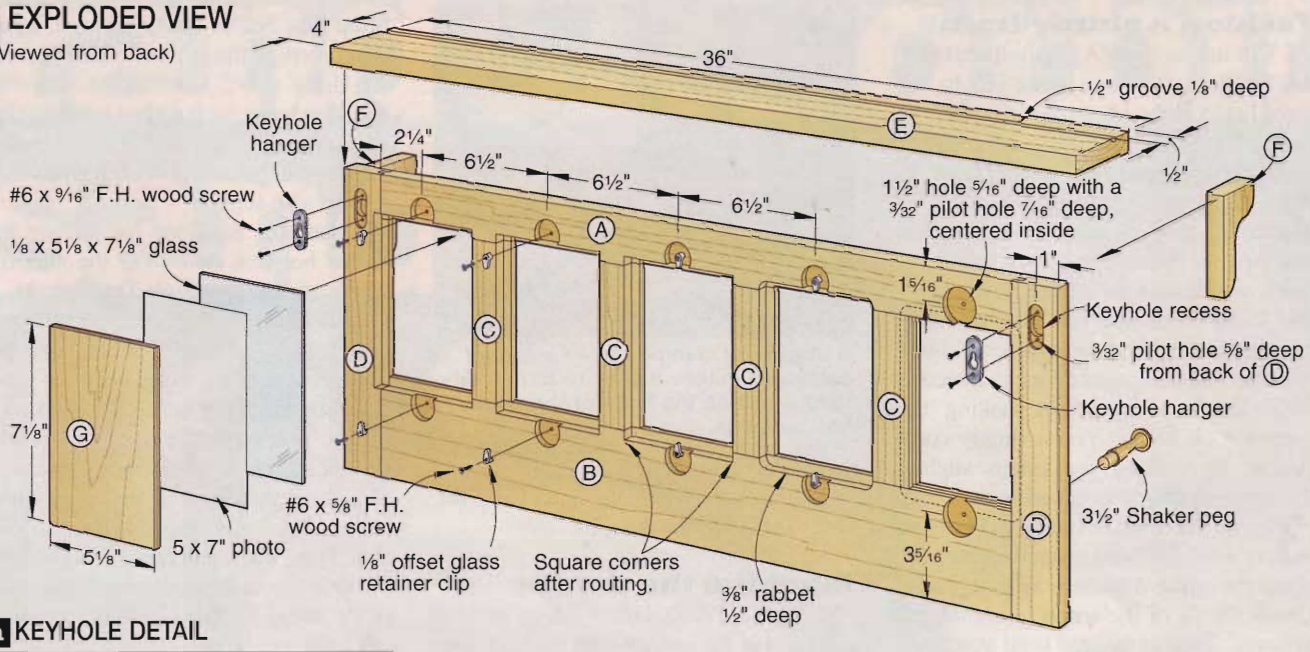


SHOP TIP

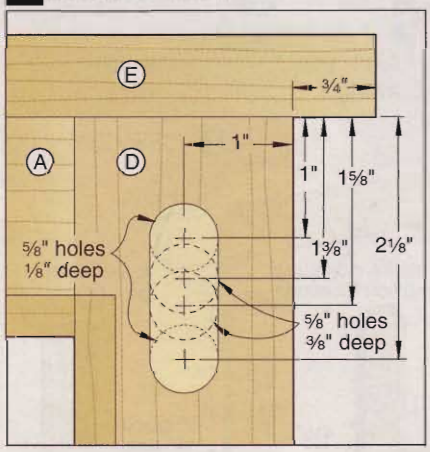
Go in reverse for a smooth cut

Here's a simple way to avoid tear-out when routing the openings on the back of the frame: Move the router counterclockwise rather than the normal clockwise direction. With this technique, known as "climb cutting," you move the router in a direction that's *with* the rotation of the bit rather than *against* it. Be sure to clamp your workpiece securely when you climb cut; keep both hands on the router; use a sharp bit; and make progressive, shallow cuts. Practice on a scrap piece first to get used to the cutting action.

3 EXPLODED VIEW
(Viewed from back)



3a KEYHOLE DETAIL



Add the shelf, brackets, and backs

1 With a ½" roundnose bit, rout a ⅛"-deep groove along the top front edge of the shelf (E) to form a chalkrail, where dimensioned on **Drawing 3**. Then, clamp the shelf (E) in place, centering it side to side and flush with the back of the top rail (A).

2 Cut two 3×4½" blanks from ¾"-thick stock for the brackets (F). Make two photocopies of the full-size bracket pattern in the *WOOD PATTERNS®* insert, and attach a pattern to each blank with spray adhesive. Bandsaw the brackets to shape. Sand smooth, and ease the curved edges. Then, glue and clamp the brackets to the stiles (D) and shelf with the brackets centered on the stiles.

3 If you're going to display photos in the frames or use just the backs (G) as fillers, cut the backs to size. For photos, also have pieces of ⅛" glass cut to the size shown on **Drawing 3**.

Finish up

1 Sand all surfaces and edges smooth to 220 grit. Remove the dust.

2 Apply a coat of stain followed by two coats of a clear finish, sanding between coats. (We used ZAR's Salem Maple stain and ULTRA fast-drying polyurethane.)

3 Install the keyhole hangers and the retainer clips using the supplied screws.

4 Refer to the sidebar "Your frame-filling options," *page 48*, for items you can place in the frames. For photographs, install the glass, photos, and backs (G) in the frame, and secure with the retainer clips. To use the backs as frame fillers, install them with cardboard spacers, and secure. For other items, omit the glass and backs, and add spacers, if necessary, so they fit snugly against the retainer clips.

5 Finally, attach the coatrack to your wall using suitable anchoring fasteners. (A #8 panhead screw fits the opening in the keyhole hangers.)

Written by **Owen Duvall**
Project design: **Chuck Hedlund**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**
Photographs: **Marty Baldwin**

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A top rail	¾"	2"	31¼"	O	1
B bottom rail	¾"	4"	31¼"	O	1
C mullions	¾"	2"	7¼"	O	4
D* stiles	¾"	2"	12½"	O	2
E shelf	¾"	4"	36"	O	1
F* brackets	¾"	2⅜"	4"	O	2
G backs	⅛"	5⅛"	7⅛"	OP	5

*Parts initially cut oversize. See the instructions.

Materials Key: O–oak, OP–oak plywood.

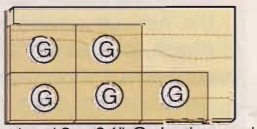
Supplies: Spray adhesive, ⅛x5⅛x7⅛" glass panels (5).

Blades and Bits: Dado blade, ⅜" piloted rabbeting bit, ⅝" and 1½" Forstner bits, ½" roundnose bit.

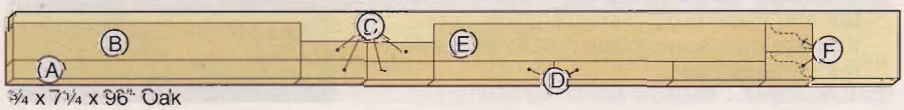
Buying Guide

Hardware. Keyhole hangers no. 125505, $.99 for pack of 2 with screws; ⅛" offset glass retainer clips no. 130329, $1.99 for bag of 10 with screws; oak 3½" Shaker pegs no. 50G10, $4.99 for bag of 10. Order from Woodcraft, call 800/225-1153 or go to www.woodcraft.com.

cutting diagram



¼ x 12 x 24" Oak plywood



¾ x 7¼ x 96" Oak

timber framing from the ground up

Building a structure a woodworker can appreciate

Woodworkers and carpenters often view their disciplines differently. Woodworking demands exacting cuts and precision to achieve great results. Homebuilding, on the other hand, may involve rough cuts and a little "persuasion" to get a good fit.

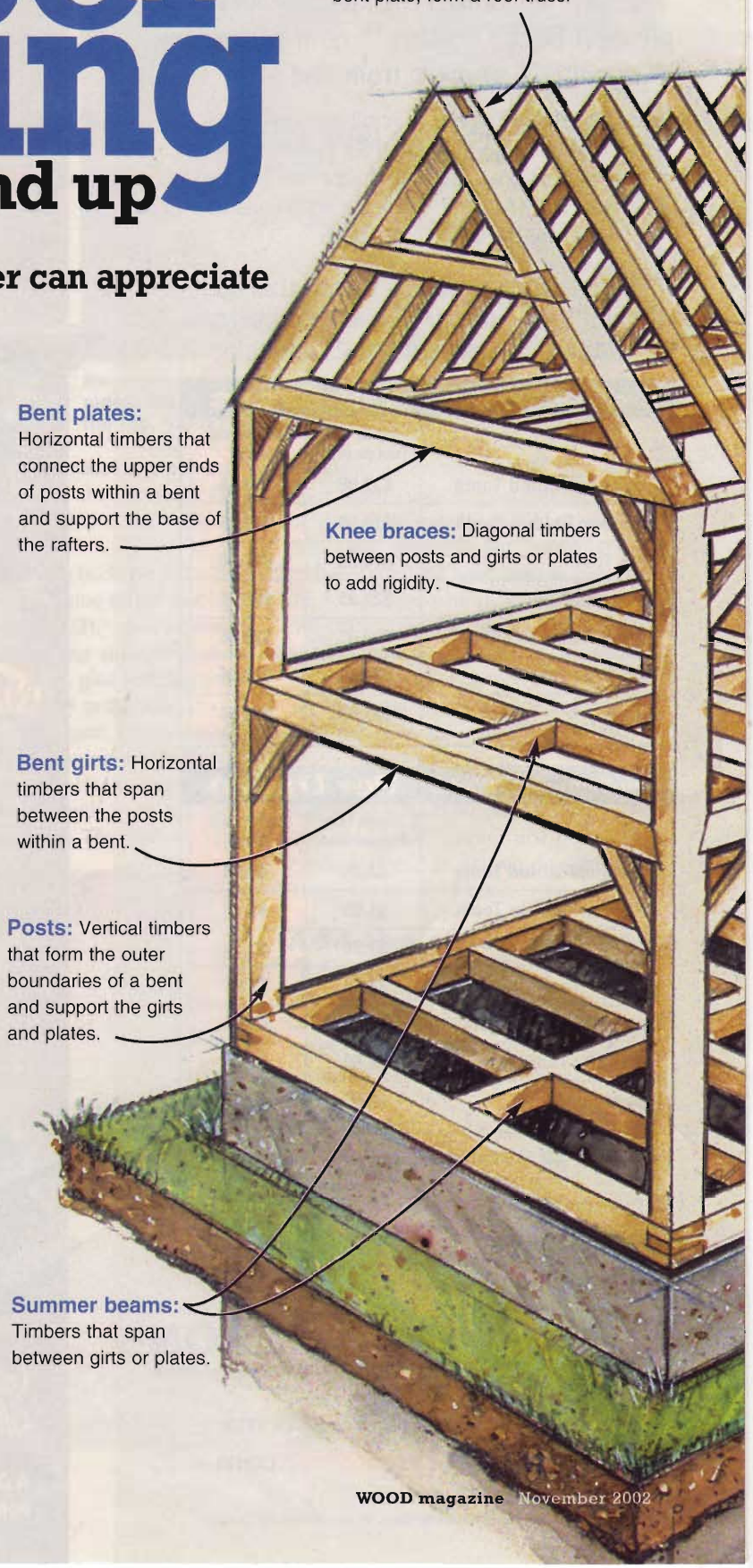
Long before the invention of modern construction techniques, though, people built structures using methods much like we employ in woodworking. Called timber frames, these buildings consist of heavy wooden posts, beams, and other parts joined using precise, artful joints.

Timber-framing methods, and some of the structures themselves, have existed for centuries. But timber framing almost became a lost art in the mid-1800s as carpenters turned to simpler stud framing. Today, people have rediscovered these beautiful, practical structures.

Perhaps the best news is that any woodworker can build a timber frame. Like yesteryear's timber framers, many of whom were inexperienced homesteaders with few tools, you can learn these time-honored techniques.

You probably won't tackle a house or barn like our ancestors did, but you can build a modest structure, such as a shed. All you need is an assortment of tools, a few friends to help heft timbers, and a willingness to learn. Here are the basics of how a timber frame goes together.

The recipe for a timber frame is simple: good wood, time-tested techniques, a few hand tools, and manpower.


Principal rafters: Roof support timbers joined at the peak and attached to a bent plate. Two rafters together, attached to a bent plate, form a roof truss.
Bent plates: Horizontal timbers that connect the upper ends of posts within a bent and support the base of the rafters.
Knee braces: Diagonal timbers between posts and girts or plates to add rigidity.
Bent girts: Horizontal timbers that span between the posts within a bent.
Posts: Vertical timbers that form the outer boundaries of a bent and support the girts and plates.
Summer beams: Timbers that span between girts or plates.

Timber frame construction at a glance

Frame configurations vary depending on the size and shape of the structure and the aesthetic aims of its designer. Also, joinery details vary widely depending on the region and the expertise of the framer. The drawing, *left*, shows a typical frame for a two-story home. Detailed drawings on the following page provide a closer look at many of the joints used in this framing system.

Because part of the wood in each timber is cut away to form mortises, tenons, dovetails, and other interlocking shapes, many of the timbers for a large frame, such as a house or barn, must be quite hefty (8×10" or 8×12"), and therefore require extra muscle power—or hoists—to maneuver them into position for shaping and fitting.

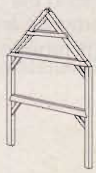
Common rafters: Secondary rafters located between bents.

Purlins: Horizontal timbers that connect roof trusses.

Collar ties: Horizontal timbers that span between rafters to prevent sagging.

Connecting girts: Horizontal timbers that span between posts in two bents.

Sills: Horizontal timbers that rest on the foundation.

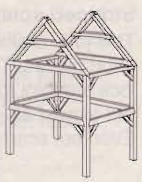


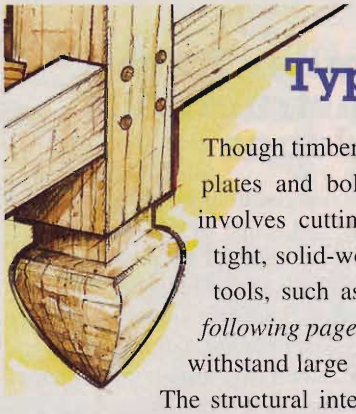
Bent: The principal unit in a timber frame, *above*, consists of two posts connected by bent girts, bent plates, and knee braces. Rafters and sills may be included. Bents are often constructed on the ground, then raised into position using ropes and poles (or a crane). A timber frame for a typical two-story house consists of four bents joined together to form three bays.

Girders: Horizontal timbers that span between sills.

Joists: Parallel timbers that span between other floor timbers to complete the floor support system.

Bay: The box area formed by joining two bents together with connecting girts, as shown at *right*. Every timber frame has at least one bay, though most, such as the example, *above*, contain more. In a traditional house layout, main rooms occupy the outer bays. Hallways, stairs, bathrooms, and service areas are clustered in a narrower middle bay.

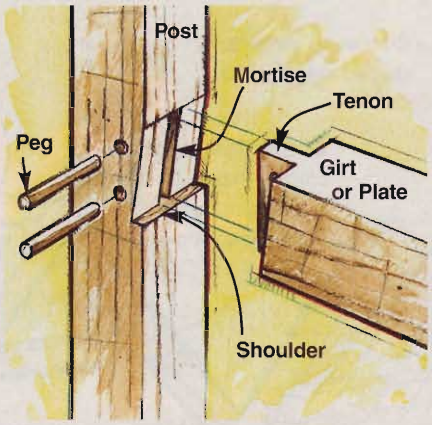




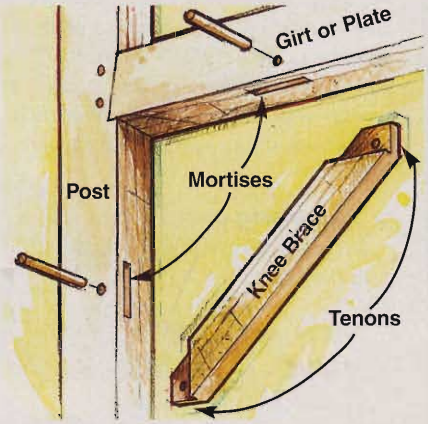
Typical timber joinery

Though timber frames can be joined using lag screws or metal plates and bolts, the most authentic and appealing method involves cutting, shaping, and pegging the timbers to form tight, solid-wood joints. The work requires only simple hand tools, such as those in "A timber framer's toolbox" on the *following page*. Yet the sturdy joints these tools help create can withstand large loads almost indefinitely.

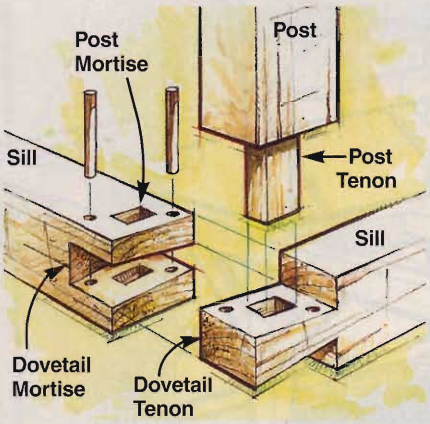
The structural integrity of these joints relies on two basic workhorse features: mortise-and-tenon cuts (square or dovetailed) and wooden pegs. The other "glue" that holds some joints and the frame at large together is simple gravity. All loads transfer through the posts to the foundation.



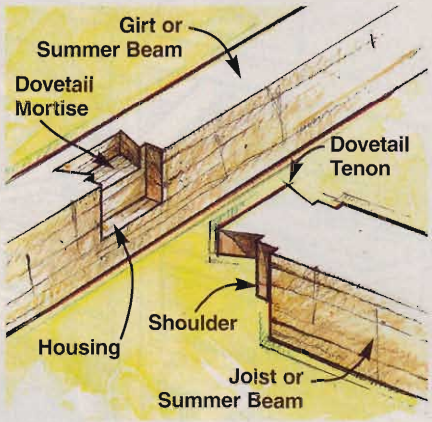
Shouldered mortise and tenon: This serves as the basic joint between the posts and girts or plates. The shoulder takes the load off the tenon, adding strength, while pins prevent the joint from pulling apart under lateral stresses.



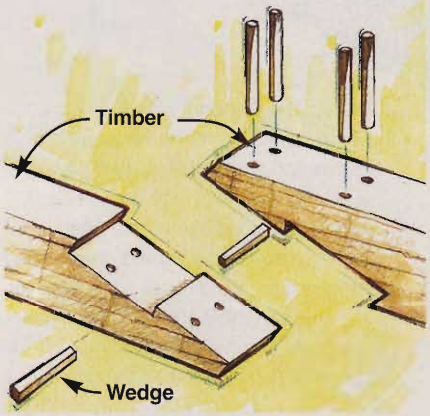
Knee brace mortise and tenon: This is one of the most common of several ways to join the knee brace. The tenons are offset, placing the brace toward the outside. Tight tolerances and gravity hold it together, while pegs provide added insurance.



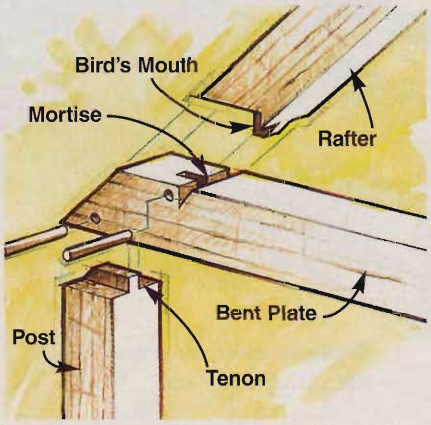
Dovetailed sill corner joint with tenoned post: Eventually, all loads in a timber frame are transmitted to the base of each post. This super-secure joint locks all the pieces together to prevent the base of the structure from splaying.



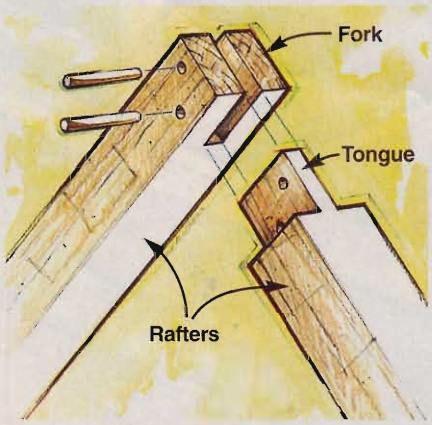
Housed dovetail: Where joists or summer beams meet girts and sills, this joint provides strength two ways. The shouldered area, or housing, bears the load. The dovetail prevents the joint from pulling apart.



Stopped splayed scarf joint: This joint creates a long timber from two short pieces. The angles, wedges, and pins lock the joint together making a scarfed timber almost as strong as a continuous one. Even so, scarfs are often placed near posts.



Tenoned and pegged rafter bird's mouth at bent plate: Where a principal rafter, post, and plate come together, this joint provides three-way protection against failure. The bird's mouth can be used with common rafters, though it's not necessary.



Tongue and fork: This simple joint consists of an open mortise and an interlocking tenon, held fast with pegs. It ties rafters together at the roof peak, and also presents a simple way to join sills where they meet at corners.

A timber framer's toolbox

To make precision cuts and tight-fitting joints, a timber framer relies chiefly on artful handling of simple tools and subtle application of leverage and pressure. The tools shown *below* have been and still are the standard issue for any timber framer. Other essentials include a framing square, a combination square, flat chisels, a mallet, and a handsaw.

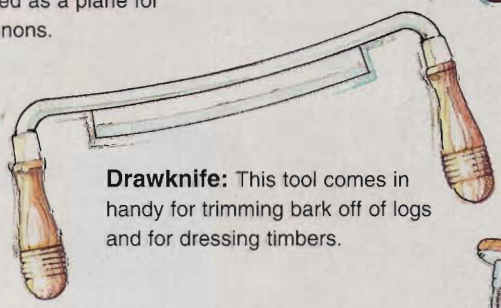
You may own some of the tools already. Specialty retailers (see the sources, *below right*) carry the others.

Today's timber framers do employ some power tools. Few hand-hew their beams, for example. Instead they rely on a motorized mill to process the logs. A router, circular saw, and power planer also are handy for trimming timbers and forming joints.

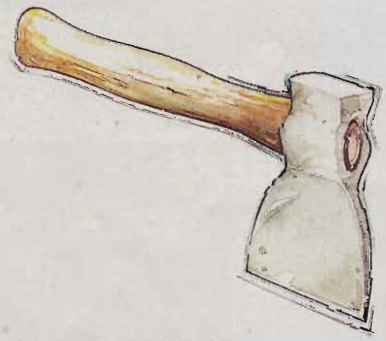
Corner chisel: Handy for cutting mortise corners quickly.

Commander: An oversize mallet (sometimes made on site with a piece of scrap timber) used for hammering joints together.

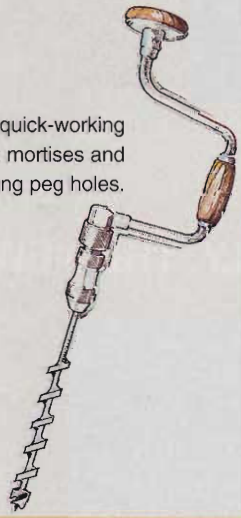
Slick: Looks like an oversize chisel but used as a plane for smoothing tenons.



Drawknife: This tool comes in handy for trimming bark off of logs and for dressing timbers.



Broad ax/hatchet: For hewing and dressing timbers, plus roughing out joinery.



Brace and bit: A quick-working tool for drilling out mortises and making peg holes.

The best woods for timber framing

One common misconception about timber framing is that the timbers need to be seasoned before you work them. Quite the opposite is true; timbers should be worked while the wood is green.

A variety of species have been used over the years, from pine and fir to oak and even cherry. These days, framers also use Douglas fir.

The strongest species for timber framing are those that grow slowly, are straight and tall (curved or twisted trees are harder to mill into timbers), and reach great heights before branching (knots tend to weaken a timber). Such trees were common in old-growth forests. Although trees in second-growth forests are not quite as strong, tall, or straight, they yield timbers that work well for such projects as houses and small barns.

Written by **Bill Nolan** with **David Stone**
Illustrations: **Mike Mittermeier**
Photograph courtesy of **Timber Framers Guild**

Sources for additional information

To learn more about timber framing, or to find the tools used in the craft, contact the following sources:

General information and training

Timber Framers Guild
P.O. Box 60
Becket, MA 01223
888/453-0879; www.tfguild.org
Education, training materials, books, workshops

Joiners Quarterly magazine
Fox Maple Press, Inc.
65 Corn Hill Road, P.O. Box 249
Brownfield, ME 04010
207/935-3720; www.foxmaple.com
Magazine, framing school, workshops, books

Tools and supplies

Barr Specialty Tools
P.O. Box 4335
McCall, ID 83638
800/235-4452; www.barrtools.com

Lee Valley Tools, Ltd.
P.O. Box 1780
Ogdensburg, NY 13669-6780
800/871-8158; www.leevalley.com

Woodcraft Supply
560 Airport Industrial Park
P.O. Box 1686
Parkersburg, WV 26102
800/225-1153; www.woodcraft.com

candles on a curve

Create a simple yet graceful stand for five votive candles.

Note: Before starting this project, purchase the votive candle holders. To ensure that they will fit on the rests, drill a 1⅞" hole 3/16" deep in scrap, and take it to the store with you.

Start with the piers

1 Laminate two ¾×2¾×8" pieces of stock to make a 1½"-thick blank for the piers (A). With the glue dry, joint one edge of the blank, and trim it to 2½" wide. From this blank crosscut two 1½×2½×3" pier blanks.

2 Make four copies of the pier full-size end pattern on the *WOOD PATTERNS®* insert. Using spray adhesive, adhere a pattern to each end of both pier blanks. Align the pattern's centerline with the blanks' glue lines. Use your drill press to drill the ¼" holes ⅜" deep where indicated on the patterns.

3 Taper the piers, bandsawing to the waste side of the pattern lines, as shown in the **Shop Tip**, *right*. Sand the sides smooth.

4 Chuck a chamfer bit in your table-mounted router, and rout the ⅛" chamfers on the piers' ends, where shown on the pattern and **Drawing 1**.

5 Plane a ¾×2×10" piece of stock to ⅜" thick for the bases (B). Cut the bases to size, and rout ⅛" chamfers on their top edges, where shown on **Drawing 1**.

6 Sand the piers and bases to 220 grit. Clamp them together with the piers centered on the bases. Drill pilot and countersunk shank holes, where shown, and drive in the screws.

Form the arches

1 Plane two ¾×2⅜×30" pieces of stock to ⅜" thick to make blanks for the arches (C). Stick the blanks together face-to-face with double-faced tape. Make three copies of the pair of arch full-size half patterns on the pattern insert. Using spray adhesive, adhere one pair of arch patterns to the blanks, joining the pattern halves where indicated. Set the other pattern copies aside. Bandsaw and sand the arches to the pattern lines. We adhered sandpaper to waste pieces cut from the arch blank to make custom-contoured sanding blocks. Separate the two arches.

2 Cut the remaining two copies of the pair of full-size half patterns along the pattern lines. Adhere them to the inside surfaces of the arches. Drill the ¼" holes ¼" deep, where indicated.

3 With the chamfer bit still in your table-mounted router, rout 1/16" chamfers along the outside edges of the arches, where shown on the pattern and **Drawing 1**. Sand the arches to 220 grit.

Now make the rests

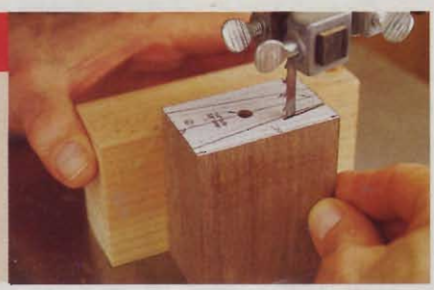
1 Plane a ¾×2⅛×18" board to ⅜" thick for the rests (D). Cut five 3"-long rest blanks. Make five copies of the rest full-size pattern on the pattern insert, and adhere the patterns to the blanks.

2 Chuck a ¼" bit in your drill press, and drill centered holes ⅜" deep in the blanks' ends. Use your drill-press fence

SHOP TIP

Scrapwood keeps fingers safe

When bandsawing small workpieces such as the piers, attach the blanks to a 2×4 scrap with double-faced tape, as shown in the photo, *right*. Thick cloth-backed tape works best.



and a stopblock to position the rest blanks.

Switch to a 1⅞" Forstner bit. Lay the blanks flat, reposition the fence and stopblock, and drill the 3/16"-deep recesses, where shown on the pattern.

3 Bandsaw and sand the rests (D) to their finished shape. Ease the edges of the curved sides with a sanding block. Sand the rests to 220 grit.

Assemble and finish

1 Cut 14 pieces of ¼"-diameter dowel ⅝" long. Dry-assemble the parts, where shown on **Drawing 1**. Use a straight piece of scrap 18" long to align the rests parallel to each other, as shown in **Photo A**. We shimmed the inside pair of rests 3/32", the outside pair 7/16". When you are satisfied with the fit and alignment, glue and clamp the parts.

2 Apply a clear finish. We sprayed two coats of satin polyurethane from an aerosol can, sanding lightly with 220-grit sandpaper between coats.

Written by **Jan Svec** with **Jeff Mertz**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**
Photographs: **Marty Baldwin**

Clamp an alignment bar to the center rest. Insert spacers between the bar and the other rests to keep them all parallel.

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A* piers	1⅛"	2½"	3"	LW	2
B* bases	⅜"	2"	4¼"	W	2
C* arches	⅜"	2⅜"	28"	M	2
D* rests	⅜"	2⅛"	3"	W	5

*Parts initially cut oversize. See the instructions.

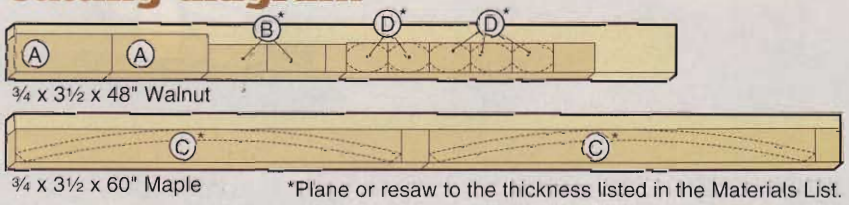
Materials Key: LW–laminated walnut, W–walnut, M–maple.

Supplies: #6x1" flathead wood screws (4), ¼"-diameter dowel 12" long, glass votive candle holders (5), votive candles (5), spray adhesive.

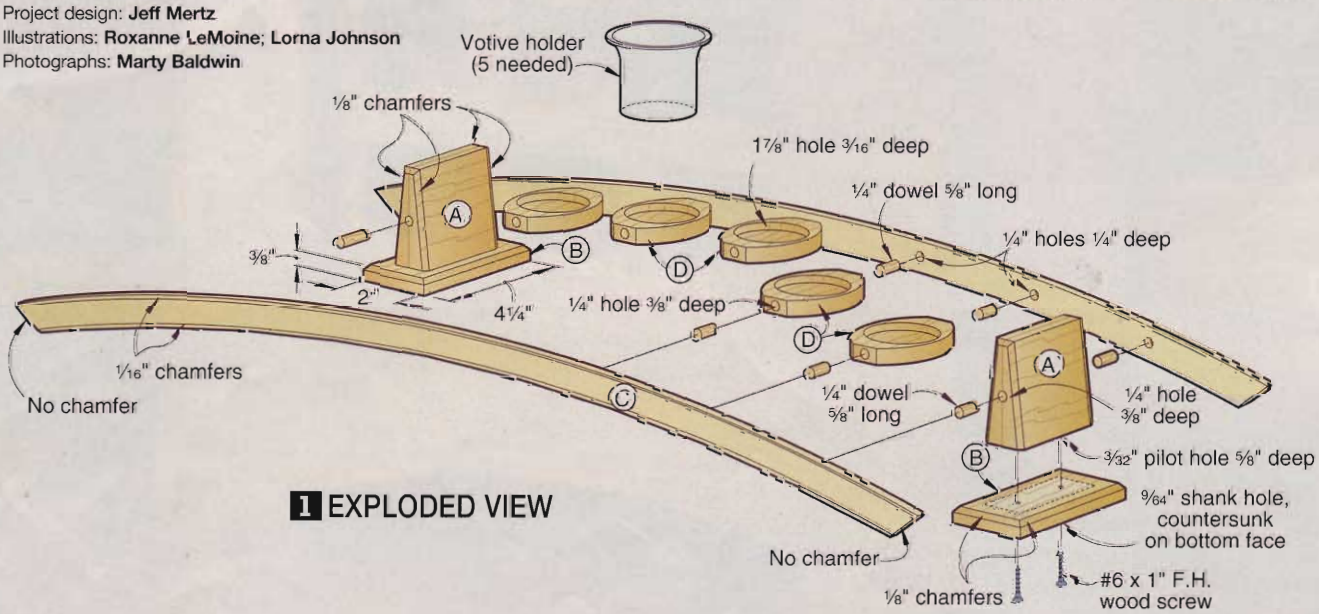
Bits: Chamfer router bit, 1⅞" Forstner bit.

Candles and holders. Look for votive candles and glass holders at department stores, gift shops, or crafts supply stores.

cutting diagram



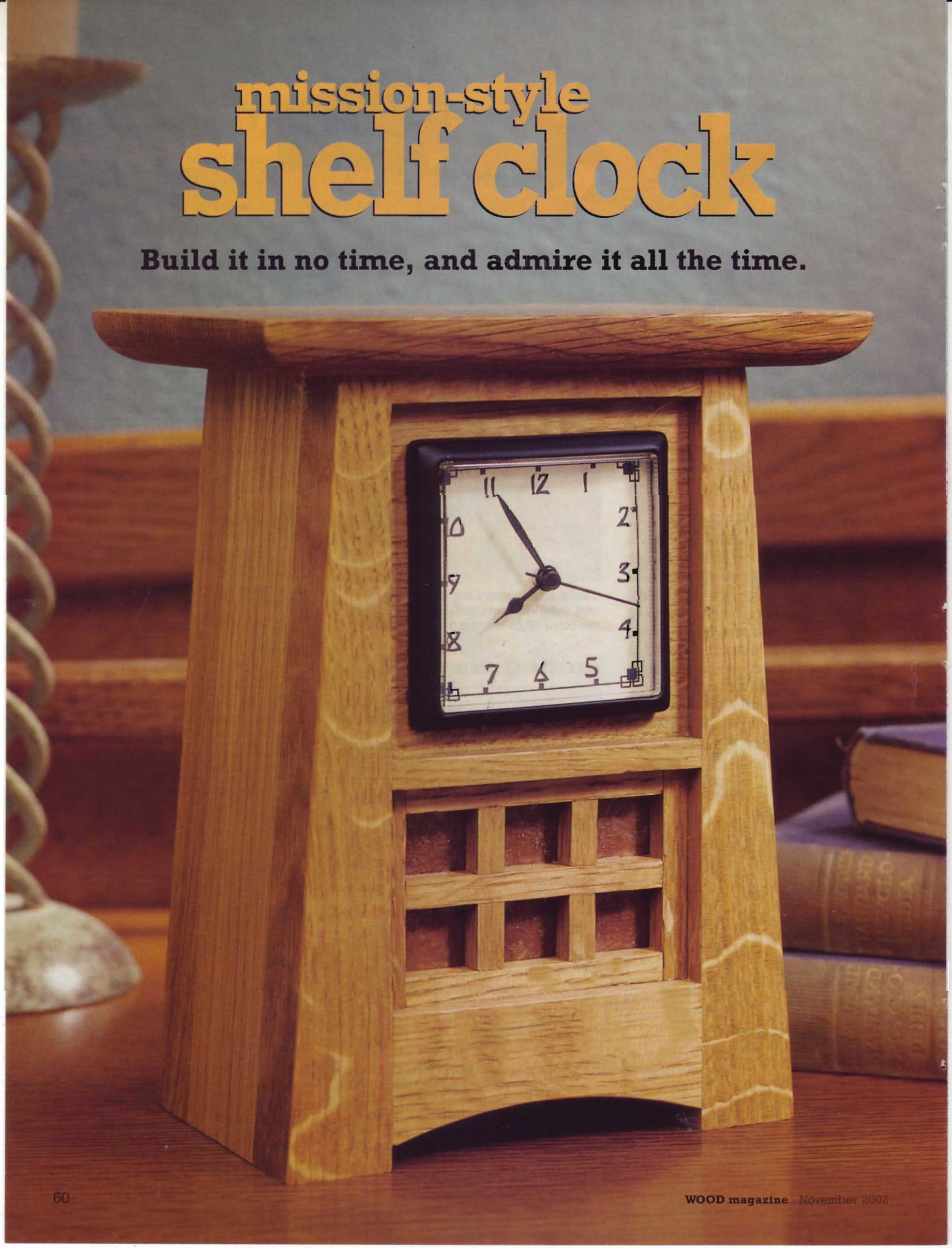
*Plane or resaw to the thickness listed in the Materials List.



1 EXPLODED VIEW

mission-style shelf clock

Build it in no time, and admire it all the time.



Looking at the simple lines, graceful proportions, and figured grain of this clock's quartersawn oak, it's easy to see why mission-style pieces are so admired. To help you achieve the same results, see the Buying Guide for a source of quartersawn oak, the clock movement, and the mica back for the clock's grille.

What is mica?

"Mica" is a general term for a group of more than 30 slightly different silicate minerals. Commonly known for their translucent properties, micas are commercially used in decorative applications such as lampshades, ceiling panels, and the grille back in our shelf clock.

Mica typically is mined in chunks that get split and further processed into films, flakes, and powders for various uses. Fabricated mica sheets, like those used in this clock, get formed by combining mica flakes with binding resins of contrasting colors.

Start with the front and back parts

1 From ¾"-thick stock, cut the stiles (A) to the size listed in the Materials List. Cut a ¼" groove ¼" deep, centered on an edge of each stile, where shown on **Drawing 1**.

2 From ½"-thick stock, cut the face (B) to size. On the back of the face, cut a ¼" rabbet ¼" deep along the side edges, where shown. You'll drill the hole in the face to receive the clock movement later.

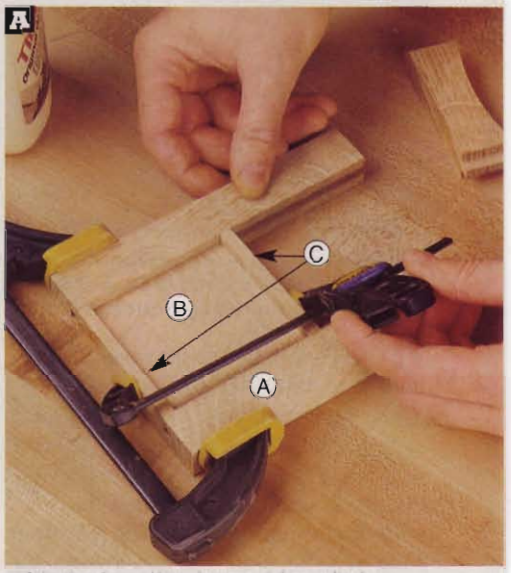
3 Cut the face-trim pieces (C) and the bottom rail (D) to size from ¾"-thick stock. Then, using a dado blade, form the ¼×¼" tenons centered on the rail ends, where shown. Make two copies of the full-size arch pattern in the *WOOD PATTERNS®* insert. Apply one pattern to a face of the rail with spray adhesive, and set the other pattern aside. Bandsaw to the pattern line to form the arch, and sand smooth.

4 From ¼"-thick stock, rip a ¼×24" blank for forming the fillers (E, F) and grille parts (G, H, I); then cut the parts to size. Set the grille parts aside.

5 From ½"-thick stock, cut the back (J) to size. Cut a ¼" rabbet ¼" deep along the sides on the inside face, where shown. Then, adhere the second copy of the arch pattern to the back at its bottom, and bandsaw and sand the arch.

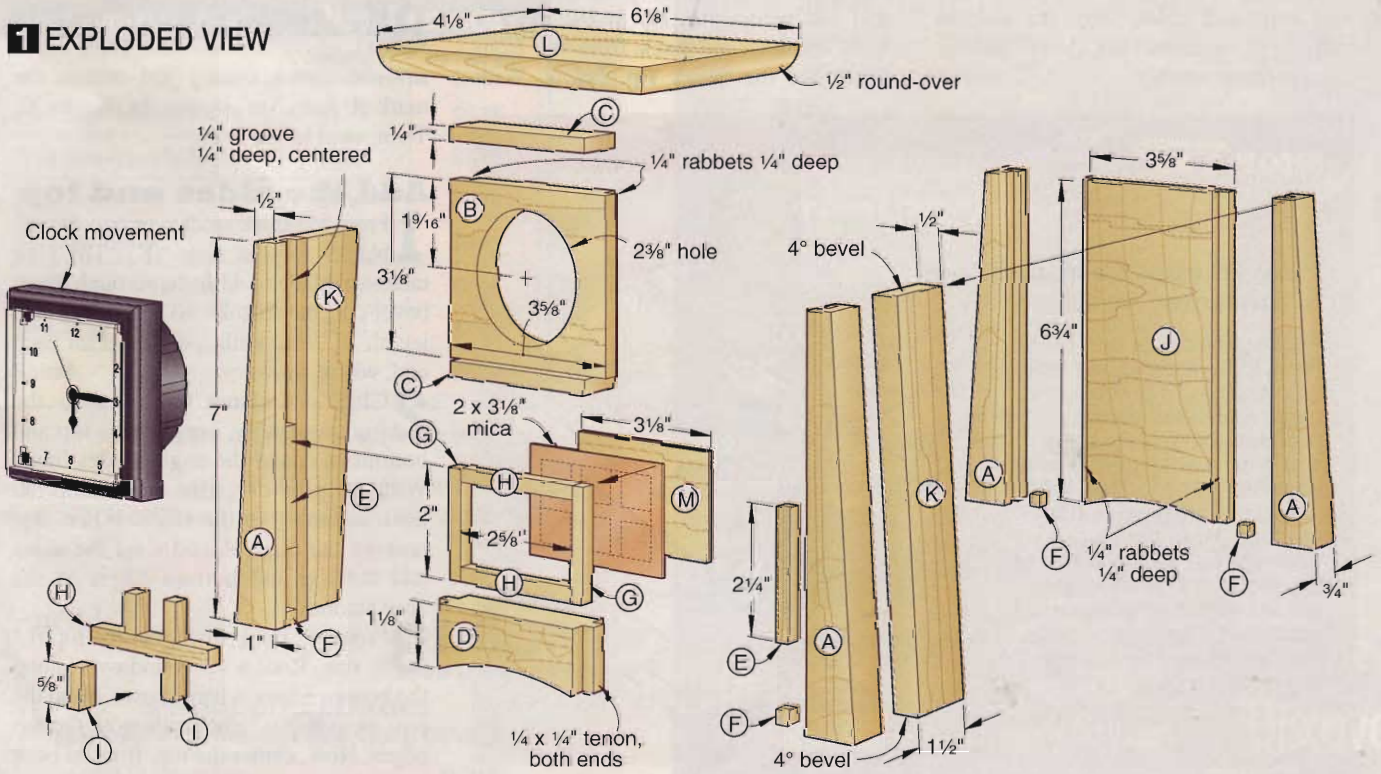
Assemble and glue the parts

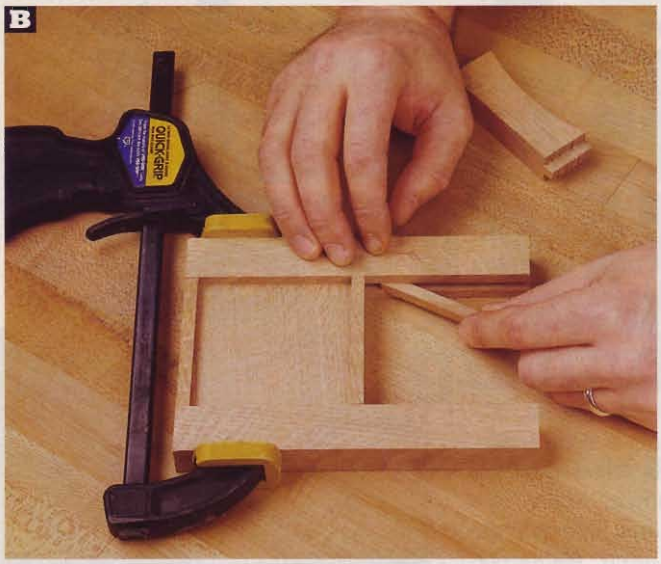
1 To assemble the front of the clock case, first place two stiles (A) and the face (B) on your work surface, outside face up. Without gluing, clamp the face between the stiles with its top edge positioned ¼" below the top of the stiles. Now, glue the face-trim pieces (C) to the face, as shown in **Photo A**.



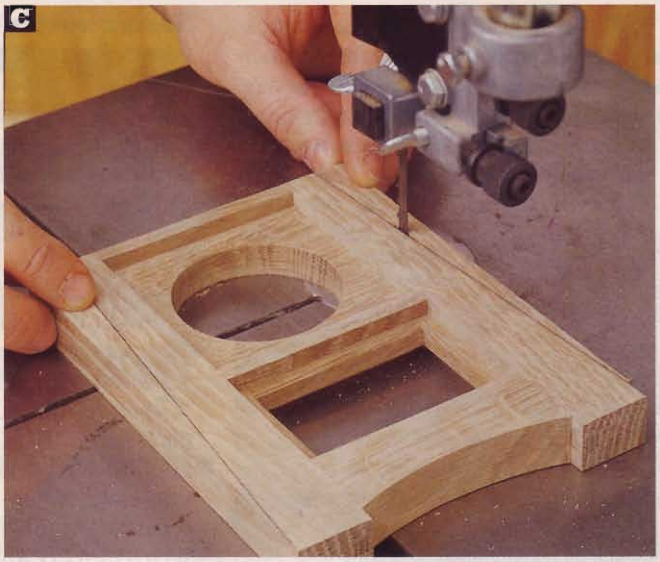
With the face (B) clamped (no glue) between the stiles (A), glue and clamp the face trim (C) to the face's top and bottom edges.

1 EXPLODED VIEW





Glue and clamp a long filler in each stile's groove, sliding it behind the bottom face-trim piece and tight against the face. Remove any squeeze-out.



Bandsaw the stiles to the marked lines to form the tapered sides. Start the cut at the bottom of the stile, and finish at the top. Sand smooth.

2 Check that the top face-trim piece is flush with the top of the stiles. Then, glue and clamp a long filler (E) in each stile, as shown in **Photo B**. This will leave 1⅜" of open groove at the bottom of each stile to receive the 1⅛"-wide bottom rail (D) and the ¼" short filler (F). Separate the stiles from the face/trim assembly.

3 Apply glue to the rabbeted ends of the face and to the bottom rail's tenons. Now, assemble the face, bottom rail, and stiles, with the bottom rail tight against the long fillers. Clamp the assembly.

4 Place a dab of glue in the stiles' grooves below the bottom rail. Then, install and clamp a short filler in each groove.

5 To assemble the back of the clock case, first apply glue to the rabbeted sides of the back (J), and clamp it between the remaining stiles with their top edges flush. Then, glue and clamp the remaining short fillers in the stiles.

6 From ¼" hardboard, cut a 1⅞×3" spacer for positioning the grille side and rail pieces (G, H) in the clock's front opening, ¼" back from the front edge. See the **Shop Tip**, *below*. With the front assembly outside face up on your work surface, position the spacer in the grille opening. Then, glue the grille side pieces to the long fillers (E) in the stiles, and glue the rail pieces to the lower face trim (C) and the bottom rail (D). Press the pieces firmly down against the spacer.

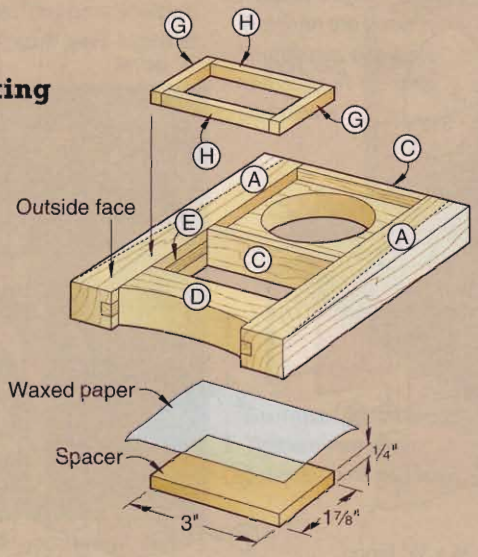
7 Using a 2⅜" Forstner bit, or a circle cutter set to cut a 2⅜" hole, drill a centered hole through the face (B) to receive the clock movement.

8 Mark the taper on each of the stiles (A), where dimensioned. Then, bandsaw the tapers, cutting just outside the marked lines, as shown in **Photo C.** Then, sand to the lines.

SHOP TIP

Prevent glue from sticking to unwanted surfaces

Glue squeeze-out can cause parts to become joined where unintended. To prevent this, place a piece of waxed paper between the surfaces that you don't want joined, where possible. For example, when gluing the grille sides (G) and the rails (H) in the clock's opening, put waxed paper on top of the spacer. The glue will not stick to the paper, so you'll find it easy to remove the spacer and scrape off any residual glue.

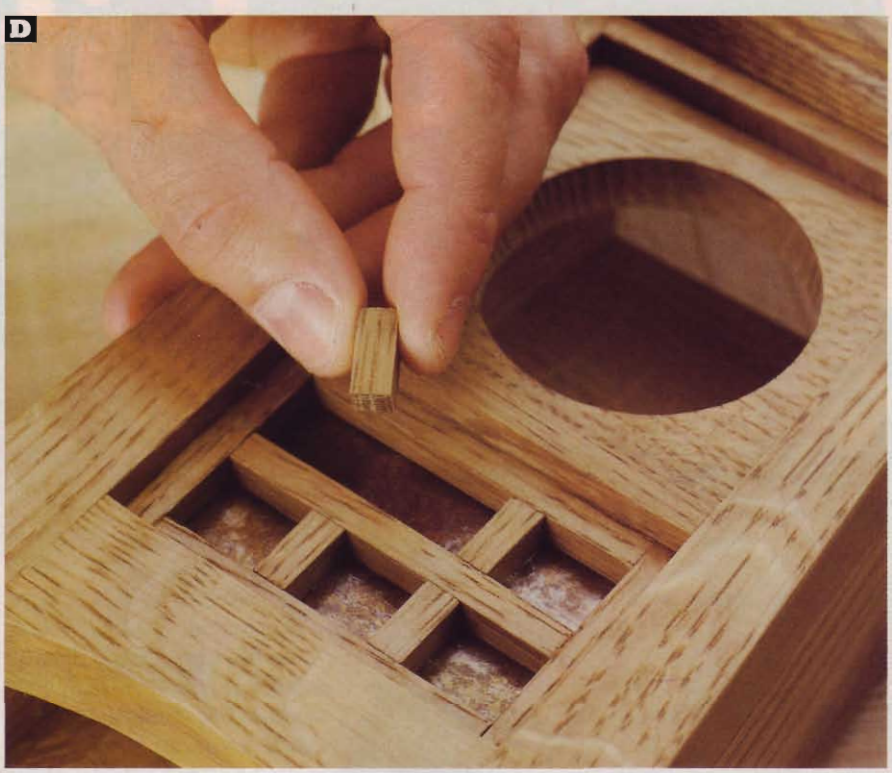


Add the sides and top

1 From ½"-thick stock, cut two 1½×8" blanks for the sides (K). Tilt your tablesaw blade to 4° from vertical. Now, bevel-cut the blanks to their finished length of 7 1/16" with a 4° bevel on each end, where shown.

2 Glue and clamp the sides to the front assembly, keeping the top and bottom ends and the angled sides flush. With the glue dry, glue and clamp the back assembly to the sides. When dry, remove the clamps, and sand the sides and the top and bottom edges of the case smooth.

3 From ½"-thick stock, cut the top (L) to size. Rout a ½" round-over along the bottom edges, where shown. Sand the top, including a light sanding of the top edges. Now, center the top, front to back



Install the remaining grille rail and uprights in position, pressing the epoxied edges against the mica. Check for proper alignment.

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A stiles	¾"	1"	7"	QO	4
B face	½"	3⅛"	3⅝"	QO	1
C face trim	¾"	¼"	3⅛"	QO	2
D bottom rail	¾"	1⅛"	3⅝"	QO	1
E* long fillers	¼"	¼"	2¼"	QO	2
F* short fillers	¼"	¼"	¼"	QO	4
G* grille sides	¼"	¼"	2"	QO	2
H* grille rails	¼"	¼"	2⅝"	QO	3
I* grille uprights	¼"	¼"	⅝"	QO	4
J back	½"	6¾"	3⅝"	QO	1
K* sides	½"	1½"	7 1/16"	QO	2
L top	½"	4⅛"	6⅛"	QO	1
M backer	⅛"	2"	3⅛"	BP	1

*Parts initially cut oversize. See the instructions.

Materials Key: QO–quartersawn white oak, BP–birch plywood.

Supplies: ¼" hardboard, epoxy, N battery.

Blades and Bits: Dado blade, 2⅜" Forstner bit or circle cutter, ½" round-over bit.

Buying Guide

Clock kit. 2⅜"-diameter press-in clock movement (1), 2×3⅛" mica (1). Kit no. MSC, $15.95 ppd. Schlabaugh and Sons Woodworking, 720 14th Street, Kalona, IA 52247. Call 800/346-9663 or go to www.schsons.com to order.

Lumber kit. Enough quartersawn white oak and birch plywood (some pieces cut slightly oversize) for one clock. Kit no. LP-4, $23.95 ppd. See *above* for address and telephone number.

Bit kit. 2⅜" Forstner bit kit no. 400901, $18.95. Address and telephone number *above*.

and side to side, on the case, and glue and clamp it in place.

Time to wrap it up

1 Finish-sand the clock case and remaining grille parts (H, I) to 220 grit, and remove the dust. Apply a stain of your choice to the clock case. Also, stain all but one edge (for gluing) of the remaining grille parts. (We used ZAR Spanish Oak wood stain.) Then, apply a clear finish. (We sprayed three coats of Watco Satin Lacquer Clear Wood Finish, sanding to 400 grit between coats, and removing the dust.)

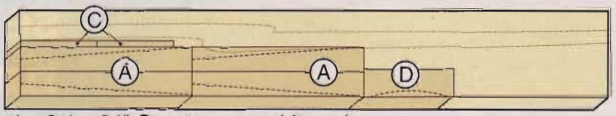
2 Cut the backer (M) to size, and cut a piece of mica (or stained glass, as an option) to the same size. (We cut our mica using a bandsaw and a zero-clearance insert.) Adhere the mica to the backer with epoxy.

3 Through the bottom of the clock case, apply a small amount of epoxy to the back of the grille sides (G) and rails (H). Insert the mica/backer through the bottom, and press it into the opening against the epoxied parts. Apply masking tape to hold the mica/backer in position while the epoxy cures.

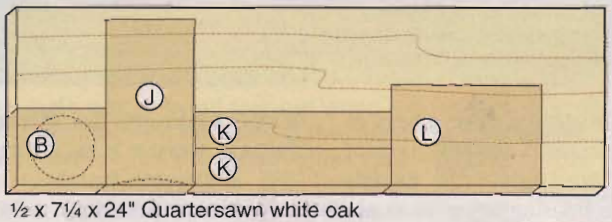
4 Apply epoxy to the unstained edges of the remaining grille rail and uprights, and install these pieces as shown in **Photo D**. Finally, install an N-size battery in the clock, set the time, press the clock into the hole in the face, and proudly place your masterpiece on a shelf for all to see.

Written by **Owen Duvall**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**
Photographs: **Marty Baldwin**

cutting diagram



¾ x 3½ x 24" Quartersawn white oak



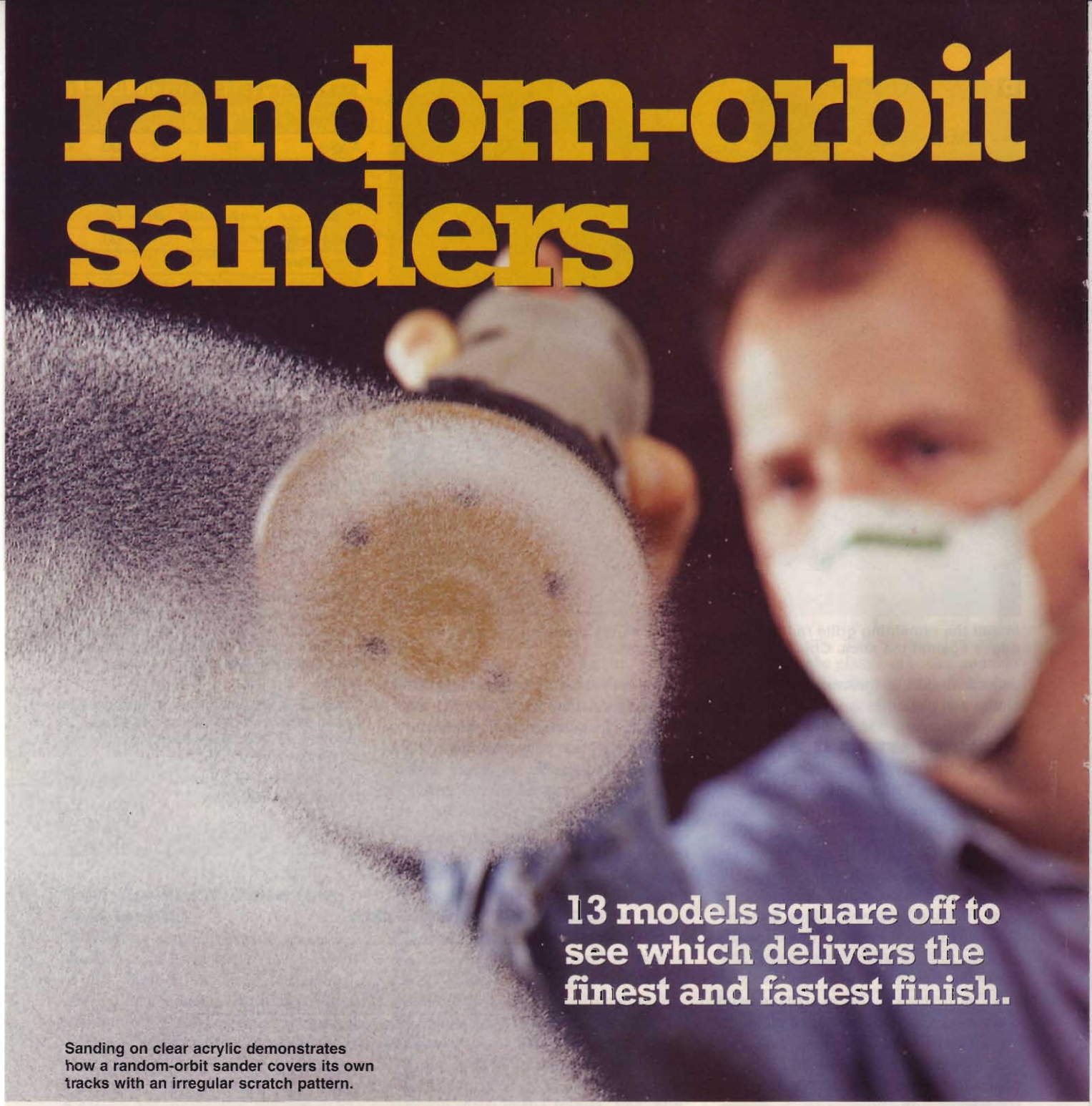
½ x 7¼ x 24" Quartersawn white oak

¼ x 2 x 24" Quartersawn white oak

⅛ x 2 x 3⅛" Birch plywood

random-orbit sanders

13 models square off to see which delivers the finest and fastest finish.



Sanding on clear acrylic demonstrates how a random-orbit sander covers its own tracks with an irregular scratch pattern.

For this article, we chose a bevy of 5" random-orbit sanders, most of which are palm-grip models where the motor housing serves as a one-handed grip. We also included side-handle sanders that can be held like a palm-grip machine or by a pair of opposing grips for two-handed control. Except for the Black & Decker RO100, Milwaukee 6019-6, and Ryobi RS241, all of the tested sanders have variable speed.

Five things to demand from your r.o. sander

1 A smooth finish. As much as we love to sand (not!), we don't want to spend any more time than necessary doing it. So, if we can eliminate the finer grits at the end of the job without leaving swirly, stain-catching scratches, so much the better.

All of the tested sanders performed well here, providing we used 120-grit or finer sandpaper and kept the tool moving. Only when we held the sander in one spot on a workpiece, then stained it, did some scratches appear. The "Finish Quality" chart, *opposite top*, shows the grits we had to sand to in oak and pine to eliminate even these scratches. The Craftsman 27957, Festool ES125 E-Plus, and Porter-Cable 333VS excelled here, saving us from stepping up two to three grits to eliminate scratches—a big time-saver.

FINISH QUALITY

Some sanders help you produce a smooth, scratch-free surface without going through a long succession of ever-finer sandpaper grits. Here's the grit we needed to sand to before the scratch patterns disappeared.

SANDER	OAK	PINE
Black & Decker RO100	220	240
Bosch 1295DVS	220	240
Bosch 3107DVS	220	220
Bosch 3725DVS	220	240
Craftsman 27957	150	150
DeWalt DW423	220	220
Festool ES125 E-Plus	150	150
Makita BO5012K	220	220
Makita BO5021K	220	240
Metabo SXE425	180	240
Milwaukee 6019-6	220	240
Porter-Cable 333VS	150	180
Ryobi RS241	180	240

*Test conducted on a single board of each species. Your results may differ.

Three sanders, three specialties

Random-orbit sanders marry the orbital action of a finish sander to the aggressiveness of a belt sander to create a fast-cutting, smooth-sanding tool. If we could have only one portable sander in our shop, it would be a random-orbit sander, though all three have their place. Here's how they compare.

This photo shows the scratch patterns left by a belt sander (top) and a finish or "pad" sander (bottom). A belt sander should be used only in line with the grain.

Belt sander

- The fast-moving abrasive belt hogs away wood quickly.
- Long, straight scratches (see photo, at *right*) make it a poor candidate for cleaning up cross-grain joints, such as those in face-frame construction.

Finish sander

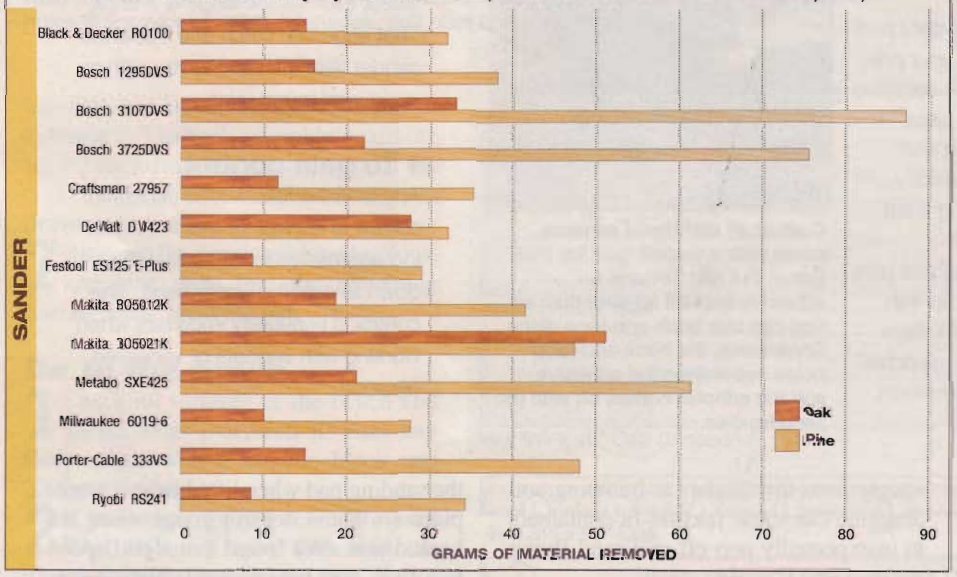
- You can sand into corners because of the square pad.
- The pad's orbital action creates tiny circular scratches (photo, *above*). With no obvious directional scratches, you can sand cross-grain joints.
- The small sanding pattern removes stock slowly, even with coarse grits.

Random-orbit sander

- Pad rotation combined with orbital motion blends the scratches into a less-detectable pattern than a finish sander. This combined action also makes it more aggressive than a finish sander.
- The round pad can't sand into corners.
- Contrary to intuition, these sanders remove *less* material when you bear down on them, so a light touch is best.

SANDING AGGRESSIVENESS

Not all sanders remove wood at the same rate, even with the same grit of paper installed. After 10 minutes of sanding with 80-grit paper, here's how many grams of wood were abraded away by each sander. (Tests conducted in red oak and pine.)



2 Aggressiveness. A random-orbit sander that takes a healthy bite when knocking down a misaligned joint will just as quickly sand through thin veneer. The chart *above* shows the side-handle sanders (Bosch 3107DVS and 3725DVS, Makita BO5021K, and Metabo SXE425) to be the most aggressive.

Such high removal rates can sometimes lead to control problems. (Even some not-so-aggressive units were difficult to keep in check, wanting to quickly change directions as we shifted pressure to the edge of the sanding pad.) If you're looking for a do-it-all sander, remember that you can dial down the speed on a feisty variable-speed model, but you can't make a lackadaisical sander more aggressive.

3 Effective dust collection. The best dust-collection method is a shop vacuum hooked up to a sander's dust port. That said, we were dis-

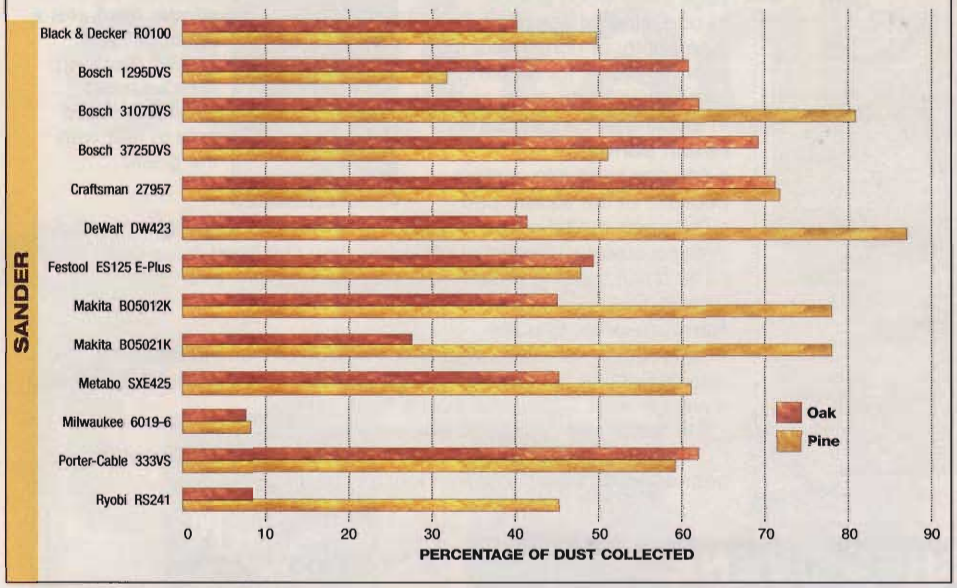
About our tests

To measure aggressiveness and dust-collection capabilities, we outfitted each sander with an 80-grit Mirka Gold sanding disc (from Supergrit Abrasives, 800/822-4003, or www.supergrit.com). After weighing a pine test board and the sander separately, we sanded the board for 10 minutes using only enough hand pressure to keep control of the sander, then weighed it again, as shown *above*. The difference shows how much material the sander abraded away.

Without emptying the sander's onboard dust receptacle, we reweighed the sander to see how much it gained. Comparing this weight change to the amount of material removed gave us the percentage of dust collected. We averaged the results of three tests, then repeated the entire procedure, this time with red oak boards.

DUST-COLLECTION RATES

Although all of the tested sanders come with their own on-board dust receptacles, we found marked differences in the amounts of sanding dust that each receptacle collected. This chart shows the percentage of sanding dust actually collected by each sander while sanding for 10 minutes. (Tests conducted in red oak and pine.)



Sanding discs: Hook-and-loop vs. self-adhesive

Abrasive discs attach to a random-orbit sander's pad in one of two ways: by hook-and-loop (like your preschooler's Velcro shoelaces) or by pressure-sensitive adhesive (PSA). We prefer hook-and-loop discs because they're reusable—you can remove and replace the discs a number of times. PSA discs can't be reattached, so you often end up throwing them away only half-spent.

And, PSA discs can slip when the sanding pad gets warm. When that happens, you could end up with sticky goo on your workpiece. Although PSA discs cost less, most sander manufacturers have switched exclusively to the hook-and-loop mounting method, so PSA discs are becoming harder to find.

Craftsman and Ryobi sanders come with a smooth pad for PSA paper, but also include an adhesive-backed adapter disc so you can use hook-and-loop discs. Sometimes, the hook-and-loop holds better than the adhesive, and the adapter comes off with the sanding disc.

Who needs variable speed?

We use random-orbit sanders in the *WOOD*® magazine shop nearly every day, and we seldom run them at anything less than full speed. So should you save $5–$10 and get a single-speed sander? We'd spend the extra money to gain the versatility. Here are a few occasions when we back the speed down:

• On small parts.

A workpiece about the same size as the sanding pad will often want to spin with the pad, even when backed by an anti-slip mat. Slowing the sander helps keep the workpiece from rotating.

• When sanding edges.

Because of the small amount of wood in contact with the spinning pad, we'll sometimes slow the sander when smoothing narrow faces, such as the edge of a shelf. That edge can catch and make the sander take off, leaving you with an accidental round-over.

• To gain control.

Any time we feel like the sander is difficult to control, or that the tool is too aggressive for the task, we slow down to gain the upper hand. This control is especially important when working with veneers or veneered plywood.

appointed at the variety of sizes and shapes of the dust ports on these random-orbit sanders. If you plan to use a shop vacuum with your sander, your best bet is to buy a vac hose and/or adapters from the same manufacturer as the sander.

All of the tested sanders have on-board dust-collection containers, most often a cloth or paper bag or paper filter. The chart, *above*, shows the percentage of sanding debris each tool gathered. Dust that wasn't collected escaped around the edges of the pad, at the dust port-dust bag joint, or through porous dust bags. We prefer dust receptacles that lock snugly onto the sander, as bumping and dragging can cause friction-fit containers to unexpectedly pop off and send flying the dust you hoped to catch.

4 Low vibration. A random-orbit sander that vibrates can be downright uncomfortable to use, making your fingers tingle or even go a little numb during long sanding sessions. Three of the tested tools (Festool, Porter-Cable, and Ryobi) felt smooth as silk as we sanded.

5 Pad brake. All of the sanders in our test, except the Milwaukee 6019-6, sport a pad brake. This device is supposed to slow the rotation of the sanding pad when lifted from a workpiece so that it doesn't gouge when set back down. (We found that a pad speed less than 400 rpm prevents such gouging.) Unfortunately, some models that claim a brake—the Black & Decker and Bosch 3107DVS—actually sped up when lifted from a work surface.

The chart at *the end of this article* shows our grade for each sander. If the pad speed exceeded 400 rpm (measured with a phototachometer) after 30 seconds of free spinning, the tool earned a D; if the pad slowed to 60 rpm or less, it earned an A.

Sander-by-sander test comparison

Black & Decker RO100, $45, www.blackanddecker.com, 800/544-6986

High points

- It's one of the least-expensive sanders in the test.

Low points

- Shifting hand pressure makes the sander "run."
- The 1½" dust port doesn't fit any vacuum hose we could find—we had to make our own adapter.
- The sanding pad sped up to 600 rpm when we lifted it off a workpiece.
- We found some play in the motor shaft that made the sander rattle when we used it.

Bosch 1295DVS, $80, www.boschtools.com, 877/267-2499

High points

- Whether running at high speeds or low, this model went wherever we moved it without resistance.
- Comfortable soft-grip surface on motor housing.
- Sanding pad nearly stops spinning when lifted.

Low points

- The locking tabs on the dust-collection canister bend easily and sometimes don't latch onto the port.

More points

- Although the sander itself didn't vibrate much in-hand, it caused our test boards to vibrate loudly against the benchtop. Bosch's Chris Carlson says that new microcellular foam pads, which will be standard equipment on this and all Bosch sanders by the end of the year, should eliminate the vibration.
- Also available in a fixed-speed version (model 1295D).

Bosch 3107DVS, $100

High points

- One of the most aggressive tools in the test.
- Front handle can be adjusted up or down to suit user.

Low points

- At full speed, we found it hard to keep the pad flat on the workpiece unless we guided it with both hands. We also felt the sander wanted to guide us instead of the other way around.
- It's heavy: 5 lbs., compared to the majority of the models, which weigh between 2½ and 3½ lbs.
- The sanding pad sped up to 650 rpm when we lifted it from the workpiece.

More points

- The bag-mounting system frequently allowed the back of the bag to fall off the sander. Bosch's Jim Kraus says a pleated-paper filter like that on the Bosch 1295DVS will replace the bag beginning in January 2003.

Bosch 3725DVS, $145

High points

- Nearly as aggressive as the Bosch 3107DVS.
- A rubber palm-grip makes it more comfortable to use in that fashion than the 3107DVS.

Low points

- This unit wobbled as we sanded. Chris Carlson from Bosch said the pad on our sander apparently wasn't flat, and the new pad material (see Bosch 1295DVS, *above*) should reduce the likelihood of wobble.
- It's heavy: a little over 5 lbs.

More points

- As with the 3107DVS, the dust bag will be replaced with a pleated-paper filter in January 2003.

Craftsman 27957, $80 www.sears.com/craftsman, or visit your local Sears store

High points

- We achieved a scratch-free finish in both pine and oak with this sander using only 150-grit abrasive.
- Excellent control: The 27957 went wherever we wanted without protest.
- The pad brake is effective, nearly stopping the pad.

Low points

- The pad accepts peel-and-stick (PSA) abrasives out of the box. The hook-and-loop adapter that comes with the sander can come loose when warm.
- This sander vibrated +/-.015" at the palm grip, compared to a +/-.008 average of the other tested models.

More points

- Dust port fits standard 2½" and 1¼" vacuum hoses. However, we find a 2½" hose too stiff to use with a random-orbit sander.

DeWalt DW423, $85, www.dewalt.com, 800/433-9258

High points

- On-board dust collection is among the most effective in the test, especially in pine. The dust receptacle twist-locks to the dust port for sure attachment.
- An extra pad brake comes with the sander as standard equipment.

Low points

- This sander is difficult to control, wanting to "run" when we changed directions in our sanding stroke.

More points

- The pad brake always nearly stopped the pad in our tests, but the length of time it took varied.
- Also comes in a fixed-speed version (model DW421).

Festool ES125 E-Plus, $150, www.festool-usa.com, 888/337-8600

High points

- We achieved a scratch-free finish in both pine and oak with this sander using only 150-grit abrasive.
- Well-contoured top grip is the most comfortable in the test. We also like the large power switch.
- Very low vibration.
- Sturdy case comes standard.

Low points

- We observed a fair amount of escaped dust around the joints of the dust-port-to-bag connections.
- At low speeds, the pad had a slight tendency to chatter against the workpiece.

More points

- Festool's sandpaper discs have nine holes: the typical eight for dust extraction, and a ninth in the center to assist the dust-collection process.
- Thanks to recent price cuts at Festool, this is the same sander that sold for over $210 just a few months ago.

Makita BO5012K, $100, www.makitatools.com, 800/462-5482

High points

- On-board dust collection is near the top in the test, especially in pine. The dust bag twist-locks to the port, and the port rotates for optimal positioning in tight sanding spots.
- The excellent pad brake stopped the pad rotation within seconds.
- Carrying case comes standard.

Low points

- In spite of its excellent dust-collection rate, some dust escaped around the elastic bag opening.
- The vibration is among the highest in the test.

More points

- Also comes in a fixed-speed model (BO5010).

Makita BO5021K, $100

High points

- On-board dust collection is near the top in the test, especially in pine. The dust bag twist-locks to the port for sure attachment.
- Low vibration.
- Carrying case comes standard.

Low points

- In spite of its excellent dust-collection rate, some dust escaped around the bag opening.

More points

- It takes two hands to keep this side-handle sander in control, especially at low speeds.

Metabo SXE425, $140, www.metabousa.com, 800/638-2264

High points

- No tools are needed to remove the optional front handle, so the SXE425 is quicker to get into tight spots than the other tested side-handle sanders.

Low points

- It's 18" long from front handle to dust bag, and heavy at 5 lbs.
- While sweeping the sander to the right we felt completely in control, but leftward strokes were difficult to keep straight.

More points

- The SXE425 comes with a paper filter bag, but Metabo offers a cloth bag as an accessory. We tested both and found no difference in performance.
- Middling performance for a premium price.

Milwaukee 6019-6, $80, www.mil-electric-tool.com, 800/414-6527

Low points

- With no brake, the sanding pad quickly accelerated to 10,000 rpm when lifted from the workpiece.
- No variable speed.
- Ineffective on-board dust collection (but adequate with a vacuum and hose attached).
- After only 3–4 minutes of sanding, the palm grip gets uncomfortably warm.
- Uneven hand pressure makes the sander "run."

More points

- Milwaukee's Christopher Berg told us the manufacturer is revamping its random-orbit-sander line to correct the deficiencies of this model. Berg says the new sanders should be in stores by late 2003.

ABRADING GRADES: 5" RANDOM-ORBIT SANDERS

BRAND	MODEL	TYPE (1)	MOTOR AMPERAGE	MAXIMUM PAD SPEED (ORBITS PER MINUTE)	SANDING DISCS: NUMBER OF HOLES (2)	SANDING DISCS: MOUNTING METHOD (3)	SANDING DISCS: DUST CONTAINER TYPE (4)	PERFORMANCE REPORT CARD (5): OAK: AGGRESSIVENESS	OAK: DUST-COLLECTION EFFECTIVENESS (6)	PINE: AGGRESSIVENESS	PINE: DUST-COLLECTION EFFECTIVENESS (6)	FINISH QUALITY	CONTROLLABILITY	VIBRATION	PAD BRAKE EFFECTIVENESS	ACCESSORIES (7): STANDARD	ACCESSORIES (7): OPTIONAL	CORD LENGTH	WARRANTY (YEARS) (8)	WEIGHT (POUNDS)	COUNTRY OF ASSEMBLY (9)	SELLING PRICE (10)
BLACK & DECKER	RO100	PG	2.0	12,000	8	H&L	C	C	C	C	C	C	D-	C-	D		CC	6'	2	2.5	C	$45
BOSCH	1295DVS	PG	2.2	7,000-12,000	8	H&L	PP	C	A-	C+	D	C	A	C	A		BP,CC,MF,PP,VA,VH,SA,SP	8'	1	3.5	U	80
	3107DVS	SH	3.3	4,500-13,000	8	H&L	C	B	A-	A	A	C	C-	B	D		BP,CC,MF,PP,VA,VH,SA,SP	6'6"	1	5.0	S	100
	3725DVS	SH	3.3	4,500-12,000	8	H&L	C	C+	A	A-	C	C+	D	D-	C		BP,CC,MF,PP,VA,VH,SA,SP	8'	1	5.1	S	145
CRAFTSMAN	27957	PG	3.0	7,000-12,000	8	PSA	C	C	A	C	B+	A	A	D+	A			10'	1	2.8	C	80
DeWALT	DW423	PG	2.0	7,000-12,000	8	H&L	C	B-	C	C	A	C+	D-	C-	A	RB,VA	CC,PP,RP	10'	1	3.2	M	85
FESTOOL	ES125 E-Plus	PG	2.0	6,000-13,000	9*	H&L	P	D	C+	C-	C-	A	A	A	B	CC	SA	13'	3	2.4	G	150
MAKITA	BO5012K	PG	2.0	4,000-12,000	8	H&L	C	C	C	B-	A-	C+	C	D+	A	CC	BP,VA,VH	6'6"	1	2.9	U	100
	BO5021K	SH	2.0	4,000-12,000	8	H&L	C	A	D	B	A-	C	C-	B+	B	CC	BP,VA,VH	7'	1	3.1	U	100
METABO	SXE425	SH	3.6	5,000-12,000	8	H&L	P	C+	C	B+	B	B	C+	C	C		BP,CB,CC,SA,SP,VA,VH	8'	1	4.9	G	140
MILWAUKEE	6019-6	PG	1.8	12,000	8	H&L	C	D	F	C-	F	C	D	D	N/A		VA,VH	8'	LIFE	2.9	T	80
PORTER-CABLE	333VS	PG	2.4	5,000-12,000	5	H&L	PF	C	A-	B	B	A-	A	A	A		BP,SP,VA,VH	7'	1	3.5	U	85
RYOBI	RS241	PG	2.4	12,500	8	PSA	C	D	F	C	C-	B	A	A	B-			6'	2	2.8	C	35

NOTES:

1. (PG) Palm grip
   (SH) Palm-grip with side handle
2. (*) Standard 8-hole pattern plus a center hole
3. (H&L) Hook and loop
   (PSA) Pressure-sensitive adhesive with H&L adapter
4. (C) Cloth bag
   (P) Paper bag
   (PF) Porous foam-plastic container
   (PP) Pleated paper filter
5. A Excellent
   B Good
   C Fair
   D Below average
   F Poor
   N/A Not applicable
6. Without vacuum
7. (BP) Buffing pad
   (CB) Cloth dust bag
   (CC) Carrying case
   (MF) Micro-finishing discs
   (PP) PSA pad
   (RB) Replacement brake
   (RP) Replacement pad
   (SA) Synthetic abrasive pads
   (SP) Sponge pad
   (VA) Vacuum adapter
   (VH) Vacuum hose
8. (LIFE) Lifetime warranty against factory defects.
9. (C) China
   (G) Germany
   (M) Mexico
   (S) Switzerland
   (T) Taiwan
   (U) United States
10. Prices current at time of article's production and do not include shipping, where applicable.

Talk about these tools in our special Random-orbit Sanders forum or find specifications on other types of tools by clicking on the "Tool Comparisons" tab at www.woodmall.com.

Porter-Cable 333VS, $85, www.porter-cable.com, 800/487-8665

WOOD MAGAZINE TOP TOOL APPROVED

WOOD MAGAZINE TOP VALUE APPROVED

High points

- Virtually vibration free, it responds to user's guidance without resistance.
- We achieved a scratch-free finish in oak with this sander using only 150-grit abrasive.
- Very good onboard dust collection with a rotating port for sanding in tight areas.
- The pad brake slowed rotation to about 60 rpm when removed from the workpiece.

Low points

- At low speeds, it's easy to stop the pad rotation completely with normal pressure.
- Porter-Cable is the only major manufacturer using 5-hole hook-and-loop sanding discs, so replacement discs may be more difficult to find.
- The dust port fits a 1¼" hose, but P-C's own vac-hose adapters didn't fit on the sander.

More points

- Also available in a fixed-speed version (model 333).

Ryobi RS241, $35, www.ryobitools.com, 800/525-2579

High points

- This sander is easy to control, and earned a high rating for its low vibration.

Low points

- It takes little hand pressure to stop the pad rotation.
- No variable speed.
- The pad accepts peel-and-stick (PSA) abrasives out of the box. The adhesive-backed hook-and-loop adapter that comes with the sander can come loose when warm.

More points

- Too late for our test, Ryobi introduced a variable-speed random-orbit sander (model RS280VS), selling for $50.

We'd want these sanders in our shop

Both the Porter-Cable 333VS and Bosch 3107DVS earn Top Tool honors. Both products perform as well, or better, than sanders costing $40–$50 more. The P-C is our first choice for general use. But if you're more interested in brute force than finesse, the aggressiveness of the 3107DVS will get you through tasks faster than the P-C will.

We also awarded the 333VS the Top Value award because it pairs performance and a reasonable price so well. Sure, you could spend less, but if you use a random-orbit sander frequently, we think that over the long haul you'll be happiest with the Porter-Cable model.

Written by **Dave Campbell** with **Phillip Goodwin**

Photographs: **Marty Baldwin**

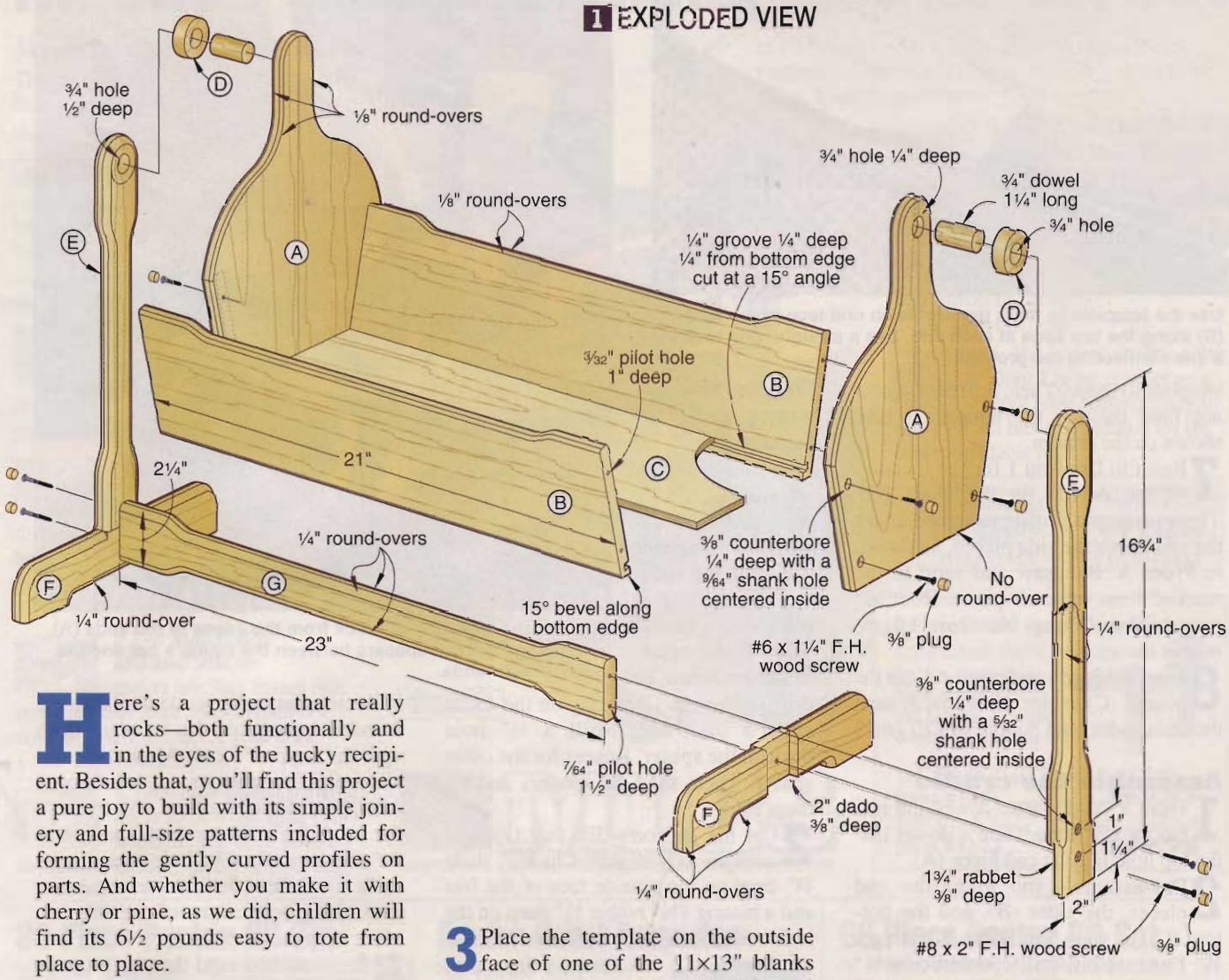
child-pleasing pendulum cradle

We scaled this playroom piece to comfortably fit popular dolls around 18" tall.

Fashioning the cradle from cherry, as featured *above*, gives it a warm and traditional look. Making it from pine, and painting it a color of your choice, lends a more casual appearance, as shown at *left*.

For the items needed to build this project, see the Cutting Diagram and Materials List on *page 73*.

1 EXPLODED VIEW



Here's a project that really rocks—both functionally and in the eyes of the lucky recipient. Besides that, you'll find this project a pure joy to build with its simple joinery and full-size patterns included for forming the gently curved profiles on parts. And whether you make it with cherry or pine, as we did, children will find its 6½ pounds easy to tote from place to place.

First up: the cradle parts

1 Edge-join enough ¾"-thick stock to form an 11×27" blank for the ends (A). Then, plane the blank to ½" thick, and crosscut it to form two 11×13" blanks.

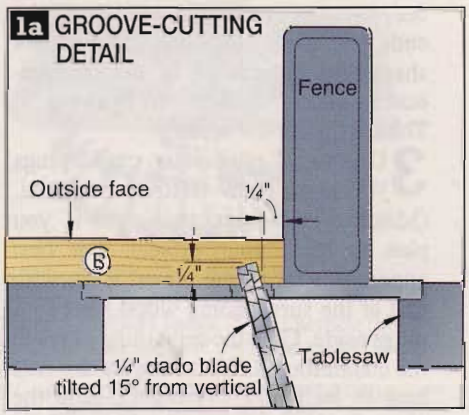
2 From ¼" hardboard, cut an 11×13" blank to form a template for the end pieces. Make two photocopies of the end full-size half-pattern in the *WOOD PATTERNS®* insert. Trim the patterns to shape. Turn one half-pattern over, and align and tape it to the other half-pattern to make a complete end pattern. Using a nail or an awl, punch a small hole through the pattern at the centerpoints for the four ⅜" counterbores and for the ¾" hole at the top. Adhere the pattern to the template with spray adhesive. Bandsaw and sand the template to shape. Then, drill ⅛" holes through the template at the punched-hole locations.

3 Place the template on the outside face of one of the 11×13" blanks with the bottom edges aligned, and transfer the shape to the blank. Also, insert a nail or an awl into each of the ⅛" holes in the template and mark the hole centerpoints on the blank. Now, mark the other blank.

4 Bandsaw and sand the blanks to shape. Using a ¾" Forstner bit and centering it on the marked hole location at the top of each blank, drill a ¼"-deep hole to receive the cradle dowel. Now, rout ⅛" round-overs on all edges except the bottom, where shown on **Drawing 1**, and sand the routed edges smooth. You'll drill the ⅜" counterbores later.

5 Cut the sides (B) to the size listed in the Materials List. Referring to **Drawings 1** and **1a**, bevel-rip a ¼" groove ¼" deep and ¼" from the bottom of each side piece on its inside face to receive the bottom (C). Then, bevel-rip a 15° angle along the bottom edge of both pieces, where shown.

1a GROOVE-CUTTING DETAIL



6 From ¼" hardboard, cut a 2½×5" blank to form a profile template. You'll use it to mark the profile on the sides (B), and later the supports (E) and the stretcher (G). Make a photocopy of the full-size profile pattern in the insert. Adhere the pattern to the hardboard with spray adhesive. Bandsaw and sand the

Use the template to mark the profile on one face of the sides (B) along the top edge at each end. Use a straightedge to draw a line connecting the profiles.

template to shape. Then, drill a ⅛" marking hole through the template where shown on the pattern.

7 Refer to **Drawing 1** for the location of the profile on the sides (B). Then, using the profile template, mark the profile on the side pieces, as shown in **Photo A**. Bandsaw and sand to the marked lines on each piece. Rout ⅛" round-overs along the top edges, where shown.

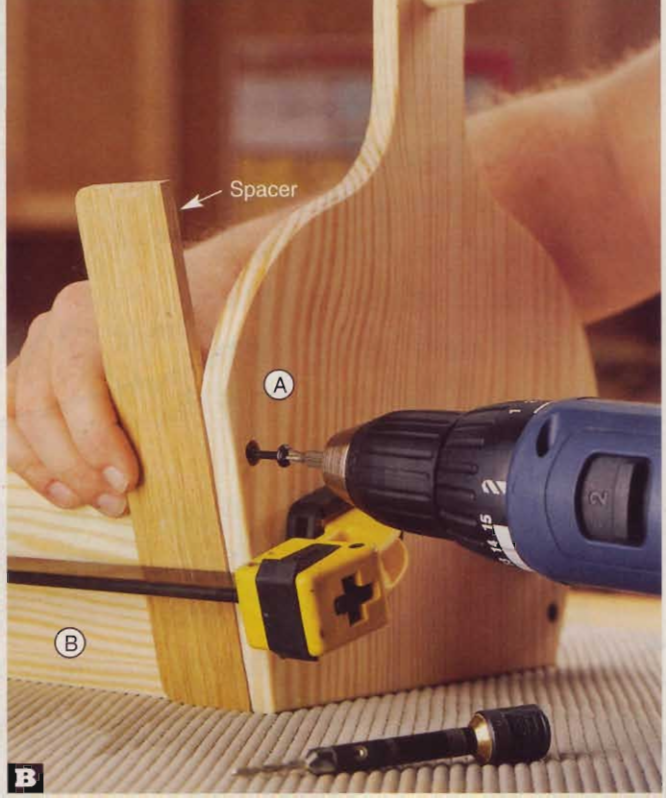
8 From ¼" hardwood plywood, cut the bottom (C) to size. Now, finish-sand the ends, sides, and bottom to 220 grit.

Assemble the cradle

1 From a ¾"-diameter dowel, cut two pieces 1¼" long. Glue a dowel into the top hole in each end piece (A).

2 Dry-assemble (no glue) the end pieces, the sides (B), and the bottom (C), as shown in **Photo B**. Using a ⅜" Forstner bit, drill counterbores ¼" deep at the marked locations on the ends (A). Drill pilot and countersunk shank holes centered in the counterbores, where shown on **Drawing 1**. Then, drive in the screws.

3 Using a ⅜" plug cutter, cut 12 plugs ⅜" long from leftover material. (Match wood color and grain if you plan to stain your project. For best appearance, align the plugs' grain with that of the surrounding wood.) Set four plugs aside. Glue the remaining plugs in the counterbores. With the glue dry (it's best to let it dry overnight), sand the plugs flush.



Position the sides (B) ¼" back from the edges of the ends (A) by placing ¼"-thick spacers between the clamp's bar and the sides at both ends.

Make the support frame

1 From ½"-thick stock, use a circle cutter to cut two 1½"-diameter discs for the spacers (D). Clamp a disc, with a backer board underneath, in a handscrew or drill-press vise. Centering on the circle cutter's pilot hole, drill a ¾" hole through the spacer. Repeat for the other spacer. Then, sand the spacers and set them aside.

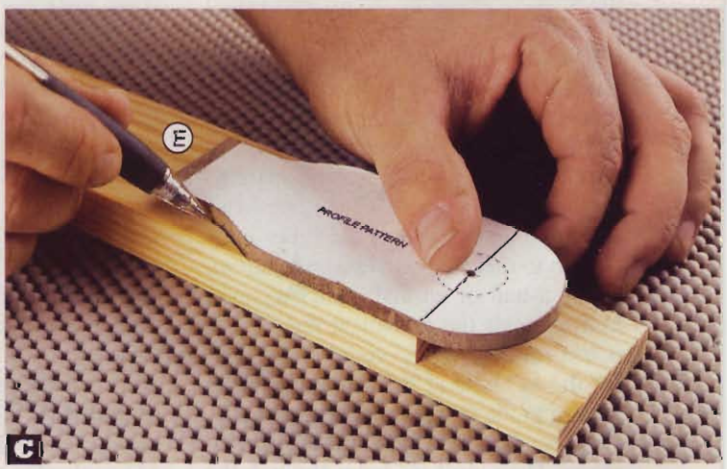
2 Cut the supports (E), feet (F), and stretcher (G) to size. Cut a 2" dado ⅜" deep on the outside face of the feet and a mating 1¾" rabbet ⅜" deep on the inside face of the supports, where shown on **Drawing 1**, to form a lap joint between the parts.

3 Referring to **Drawing 2**, lay out the 1" radii at the top ends of the feet (F) and the ¼" cutout at the bottom. Bandsaw the feet to shape, and sand smooth.

4 Refer to **Drawing 1** for the location of the profile on the supports (E). Then, mark the profile at the bottom of a support on its inside face, as shown in **Photo C**. Reposition the template at the top of the support on its inside face with the rounded top end of the template flush with the support's end. Mark the complete template contour on the support. Also, insert a nail or an awl through the ⅛" hole in the template, and mark the centerpoint for a ¾" hole to receive the cradle dowel. Draw lines to connect the contours along both edges of the support. Mark the other support.

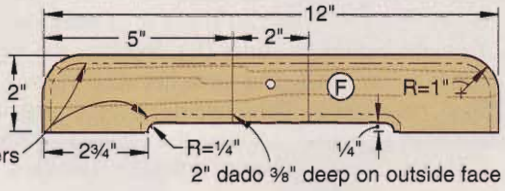
5 Bandsaw and sand the two supports (E) to shape. Using a ¾" Forstner bit, drill a ½"-deep hole at the marked location on each part.

6 Using the template, mark the profile on both ends of the stretcher (G)



With the profile template positioned on the inside face of a support (E) and aligned with the rabbet's top edge, mark the profile on the support.

2 FEET



With the stretcher (G) supported on the spacers and clamped between the support assemblies, drill pilot holes into the stretchers, and drive in the screws.

along both edges, where shown on **Drawing 1**. Draw lines to join the profiles; then bandsaw and sand to shape. Rout ¼" round-overs along the top and bottom edges of the stretcher, where shown.

7 Glue and clamp the supports (E) to the feet (F). With the glue dry, rout ¼" round-overs along the top edges of the assemblies and on the cutout area at the bottom of the feet, where shown. Using a ⅜" Forstner bit, drill ¼"-deep counterbores on the outside face of the supports, where shown. Do not drill the countersunk shank holes in the counterbores until indicated.

8 Cut two 1½"-long pieces from a ¾" dowel. Insert a dowel (no glue) into the hole in the top of each support. Now, glue and clamp the spacers (D) to the supports, centering them on the dowels. Remove the dowels.

Assemble and apply the finish

1 Mark a centerline on the top edge of the stretcher (G) at both ends, and mark a centerline with the grain on the inside face of the supports (E).

2 From scrap, cut two ⅞"-thick spacers 6" long for positioning the stretcher against the supports.

3 With the stretcher supported by the spacers at each end, clamp the support assemblies (E/F) to the stretcher, as shown in **Photo D**, aligning the stretcher and support centerlines. Now, in the center of the counterbores in the supports, drill pilot and countersunk shank holes for the mounting screws to the depth shown on **Drawing 1**, and drive in the screws. Sand the assembled frame to 220 grit, and remove the dust.

Apply paraffin wax to the cradle dowels; then install the cradle between the supports. Clamp the cradle to the support at one end to ease assembly at the opposite end.

4 Remove the screws from one support assembly, and separate it from the frame. Check the fit of the dowels in the cradle ends (A) with the hole in the spacer (D) on the removed support. Sand the dowels as necessary so they rotate freely in the spacer but are not loose. With the free end of the stretcher supported by a ⅞"-thick spacer, install the cradle in the frame, as shown in **Photo E**. Then, drive in the screws to reattach the removed support assembly. Finally, glue the four plugs that you set aside earlier into the counterbores in the supports. Let the glue dry overnight, then sand the plugs flush.

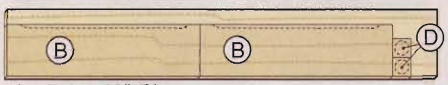
5 Check the doll cradle for any roughness and sharp edges, then sand any areas that need it. Remove the dust. To finish the cherry doll cradle, apply a stain followed by two coats of a clear finish, sanding to 320 grit between coats. (We used Minwax Cherrywood Gel Stain and aerosol polyurethane.)

6 To finish the pine doll cradle, apply two coats of primer, sanding between coats to 220 grit. Then apply two coats of a paint of your choice. (We used Glidden's interior latex flat paint, color Seed Pearl.)

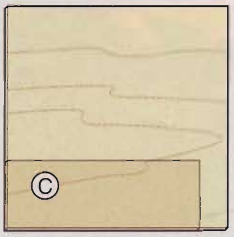
Written by **Owen Duvall**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**
Photographs: **Marty Baldwin**

cutting diagram

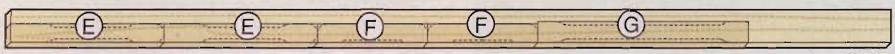
¾ x 7¼ x 60" Cherry
*Plane or resaw to the thickness listed in the Materials List.



½ x 7¼ x 48" Cherry



¼ x 24 x 24"
Hardwood plywood



¾ x 3½ x 96" Cherry

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A* ends	½"	10¾"	12¾"	EC	2
B sides	½"	5¼"	21"	C	2
C bottom	¼"	7¼"	21"	HP	1
D spacers	½"	1½" diam.		C	2
E supports	¾"	2"	16¾"	C	2
F feet	¾"	2"	12"	C	2
G stretcher	¾"	2¼"	23"	C	1

*Parts initially cut oversize. See the instructions.

Materials Key: EC–edge-joined cherry or pine, C–choice of cherry or pine, HP–hardwood plywood.

Supplies: ¼" hardboard, #6x1¼" and #8x2" flathead wood screws, spray adhesive, ¾"-diameter dowel 6" long, paraffin wax.

Blades and Bits: Dado blade, ⅜" and ¾" Forstner bits, ⅛" and ¼" round-over bits, ⅜" plug cutter, circle cutter.

scrollsawn tree trimmers

Multiple layers of thin hardwoods give these festive ornaments a light, 3-dimensional look. We've even arranged with a supplier to provide thin stock at a reasonable price. (See the Buying Guide on *page 77*.)

Saw your parts to shape

1 Make copies of the full-size ornament patterns on the *WOOD PATTERNS®* insert. The patterns for the ornament's body and onlay are combined, so you'll need two copies for each ornament you wish to make.

2 Prepare your stock. Each ornament consists of one ⅛"-thick body and two 1/16"-thick onlays, shown on **Drawing 1**. Resaw and plane the ⅛" stock, and resaw and drum-sand the 1/16" stock. You'll need one ⅛×3½×6" and two 1/16×3½×6" pieces of stock for each ornament you wish to make. (We used maple and cherry.) Adhere the patterns to the stock, arranging the patterns so each part's longest dimension is parallel to the wood grain. To save copies and time, stack-cut the parts, taping together two pieces of 1/16" onlay stock for each piece of ⅛" body stock.

3 Scrollsaw the parts to the pattern lines. We used a #2 blade with 20 teeth per inch. To make a zero-clearance table insert for scrollsawing the tiny parts, cover the insert with a couple layers of 2"-wide plastic packaging tape. The shaded areas on the angel and dove patterns designate cutouts in the bodies. Drill blade start holes in these areas, and saw them out. Drill the ⅛" holes in the tree onlays with a brad-point bit.

4 Remove the patterns. If they don't peel off easily, blot them with lacquer thinner. Remove adhesive residue from the wood by wiping it with a clean rag and more thinner. Smooth any rough edges with 220-grit sandpaper.

Paint the portion of the tree body covered by the onlay. Stay about 1/16" back from the traced pencil lines. Erase the lines after the paint dries.

Assemble and finish

1 Before gluing the tree onlays to the tree body, position one onlay in turn on each side, tracing lightly around it with a pencil. Set the onlay aside, and paint the body with acrylic craft paint, staying inside the marked lines, as shown in **Photo A**.

2 Glue the onlays to the bodies, positioning them as shown on the pattern insert. See the **Shop Tip**, *right*, for tips on gluing and clamping the parts.

3 Drill 1/16" holes through the ornaments for the decorative hooks, where shown on the patterns.

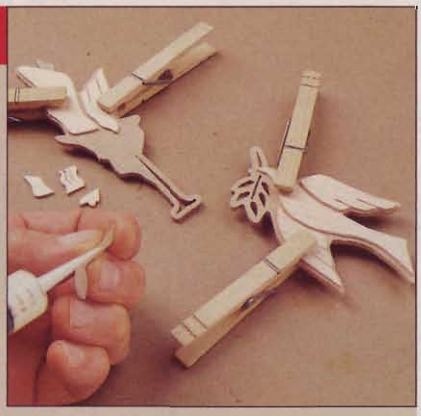
4 Sand the ornaments to 320 grit. Apply a clear finish. We used three coats of aerosol satin lacquer.

5 To make decorative ornament hangers, cut one 9"-long piece of 18-gauge copper wire for each ornament. Then, follow the steps shown in the four photos, *bottom*. Slip the completed hangers through the holes, and hang the ornaments. Twist the hooks for the best display angle.

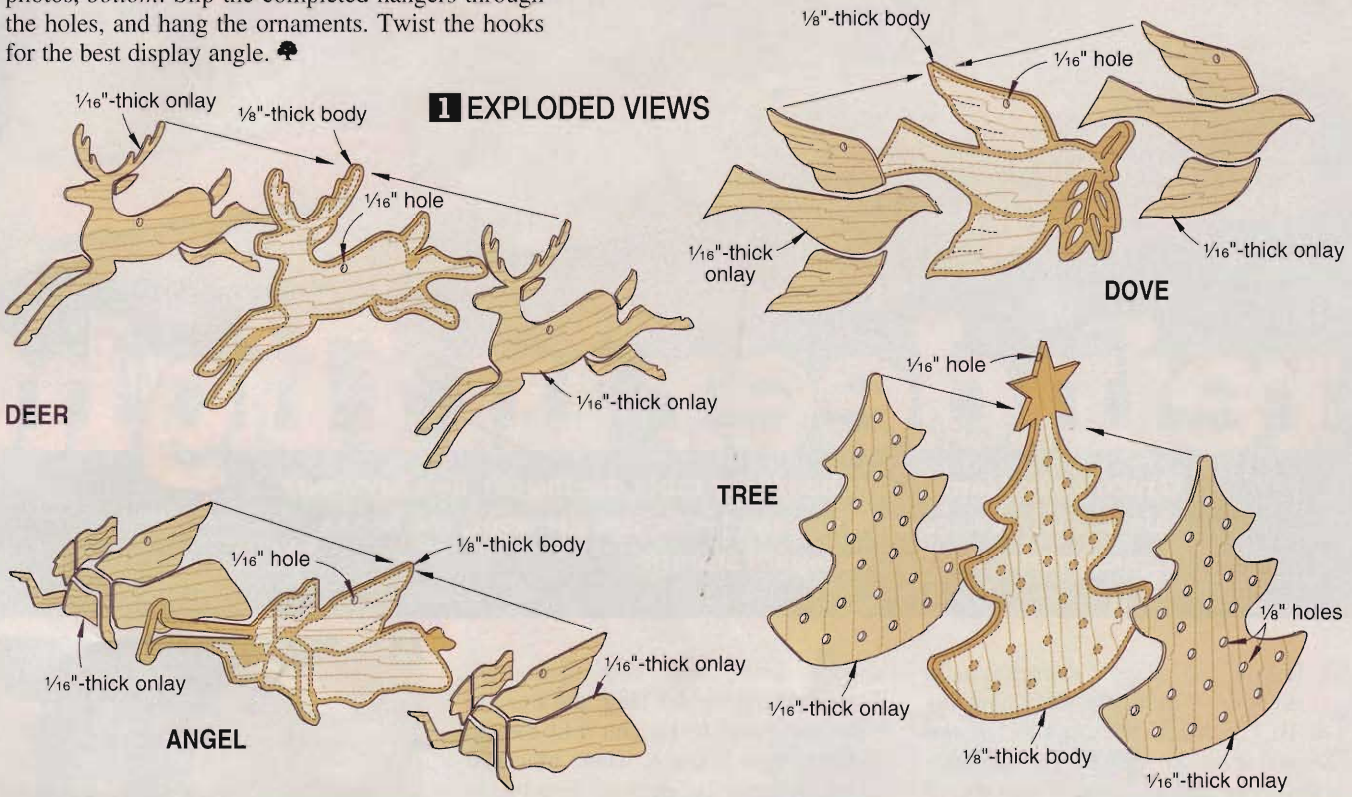
SHOP TIP

How to glue and clamp small parts

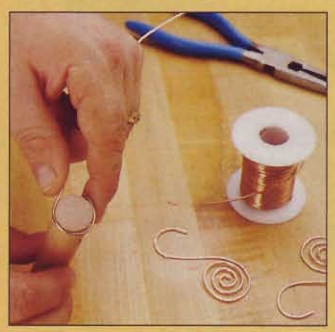
Making several copies of each ornament design leaves you with lots of little parts to hold in place while the glue dries. Spring-type clothespins, as shown in the photo, *right*, do the trick. You can buy enough to clamp up a tableful of ornaments for just a few dollars. Apply glue with a fine-tipped plastic glue injector, as shown. This allows you to lay down fine dots and beads of glue, avoiding squeeze-out.



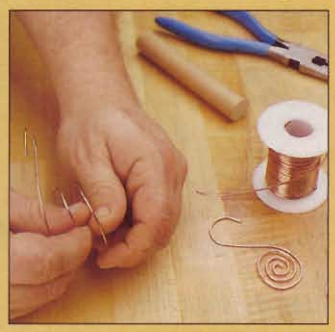
1 EXPLODED VIEWS



4 quick steps to beyond-the-ordinary ornament hangers

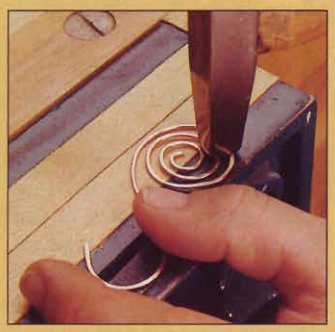


1. To form the hanger's branch hook, wrap one end of the wire around a ½" dowel.



2. Start the decorative spiral at the opposite end by bending the wire into three smooth coils.

3. Tighten the coils with needle-nosed pliers, roughly matching the pattern on the insert.



4. The hanger will keep its shape if you harden the wire by lightly hammering it on both sides.

On Dasher! On Dancer! On Prancer...

reindeer in flight

Grace your mantel, sideboard, or table during the holidays with this 3-D winter scene. When the festivities are over, the scene disassembles for flat, compact storage.

1 Resaw and plane ¾"-thick maple stock to ¼" thick for the mountains (A, B, C). Make three copies of the mountains on the *WOOD PATTERNS*® insert. Note that all three mountains are on a combined pattern with different types of lines. Cut the mountain patterns close to the lines and adhere them to your stock with spray adhesive. Scrollsaw the mountains to shape. Drill blade start holes in the patterns' shaded areas, and saw them out.

2 Chuck a ⅛" brad-point drill bit in your drill press. Drill ⅛" holes ⅜" deep, where indicated on the mountain patterns, as shown in **Photo A**.

3 Resaw and plane ¾"-thick maple stock to ¼" thick for the trees (D, E). Make four copies of each tree on the pattern insert, and adhere them to your ¼"-thick stock with spray adhesive. Drill blade start holes in the patterns' shaded areas, and saw them out. Scrollsaw the trees. Clamp the trees to your drill-press fence, and drill the ⅛" holes in their bottoms, where indicated on the patterns. Cut eight ¾"-long pieces of ⅛" dowel, and glue them in the holes.

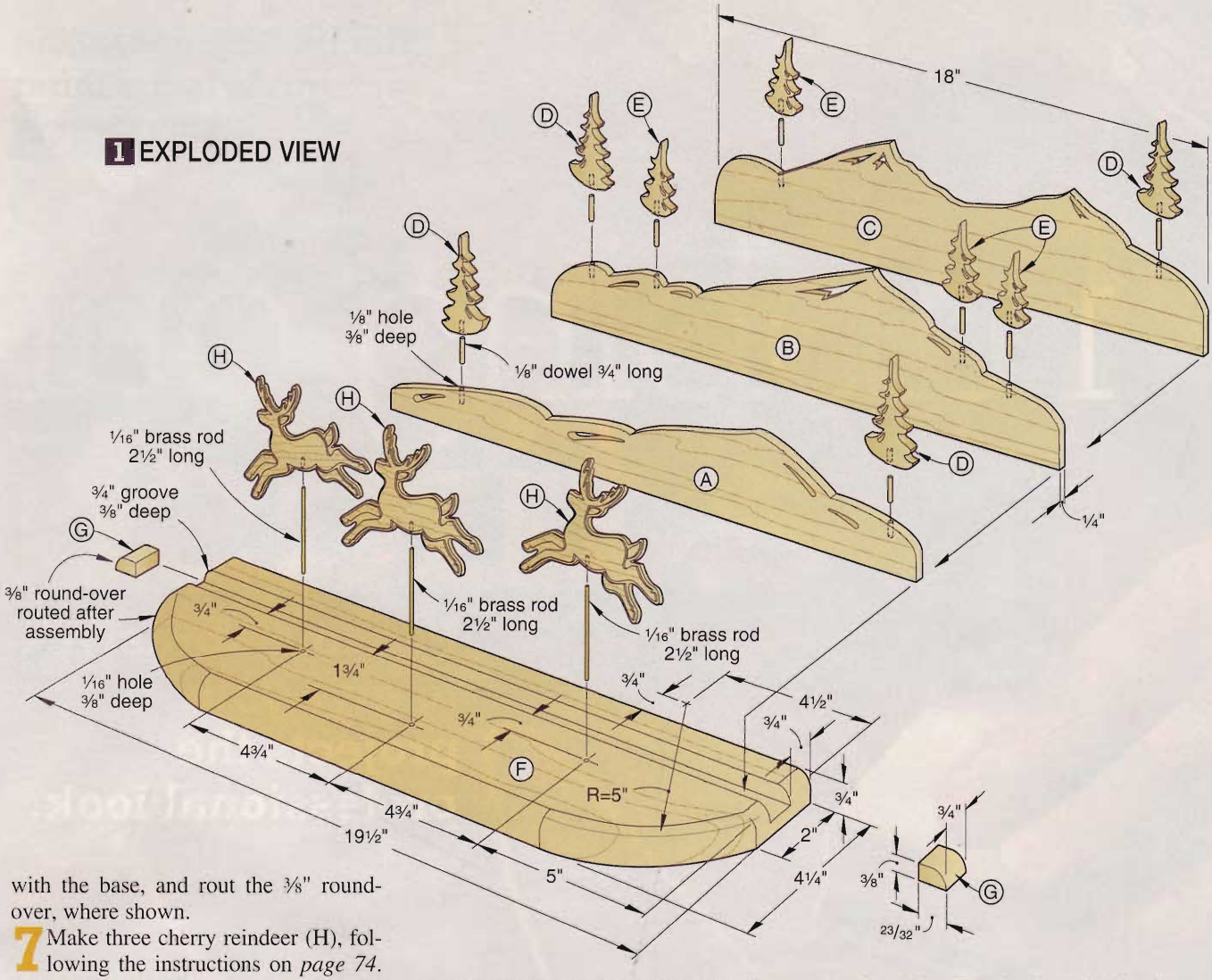
4 Cut the base (F) to the size shown. Install a ¾" dado blade in your tablesaw, and cut a ⅜"-deep groove, where shown on **Drawing 1**. Stack the three mountains together and check their fit in the groove. They should slip in and out of the groove with little play.

5 Drill the three 1/16" holes in the base, where shown. Draw the 5" radii at the base's ends, and bandsaw and sand them to the lines.

6 Cut a ⅜×¾×8" blank for the fillers (G), then cut off two 2"-long pieces. Center the mountains side-to-side in the groove. Glue the fillers in the groove, as shown in **Photo B**. Trim the fillers flush

Using your fence to align the workpieces, drill the ⅛" tree-mounting holes in the mountains, centered on their thickness.

1 EXPLODED VIEW



with the base, and rout the ⅜" round-over, where shown.

7 Make three cherry reindeer (H), following the instructions on *page 74*. Drill 1/16" holes ⅜" deep centered on the thickness of the bodies, where shown on the pattern insert.

8 Cut three 2½"-long pieces of 1/16" brass rod for the reindeer stands. Glue them into the reindeer's bodies.

9 Sand all the parts to 320 grit. Apply green aniline dye to the trees. (We used J.E. Moser Dark Forest Green water-soluble dye.) Finish with three coats of aerosol satin lacquer. With the finish dry, position the mountains in the base's groove, and insert the trees' dowels in the mountains' holes, where shown on **Drawing 1**. Insert the reindeer's rods in the base holes. Grasp the left-hand reindeer's brass rod just below its body with needle-nosed pliers, and bend the rod, angling the reindeer slightly downward. Repeat with the right-hand reindeer, but give it a slight upward angle.

B

Glue the fillers in place, leaving 1/32" gaps at each end between the mountains and fillers. Remove the mountains, and wipe any glue squeeze-out from the groove.

Written by **Jan Svec** with **Kevin Boyle**
Project design: **Mike Mittermeier**; **Karl Ehlers**
Illustrations: **Mike Mittermeier**; **Lorna Johnson**
Photographs: **Marty Baldwin**

Supplies: Spray adhesive, acrylic craft paint, spring-type clothespins.

Blades and Bits: #2 scrollsaw blades with 20 teeth per inch, 1/16" drill bit, ⅛" brad-point drill bit, stack dado set, ⅜" round-over router bit.

Buying Guide

Tree Trimmers. Enough 1/16"- and ⅛"-thick wood and 18-gauge copper wire to make four maple and four cherry ornaments, kit no. W-145A, $25.95 ppd. Enough 1/16"- and ⅛"-thick wood and 18-gauge copper wire to make twenty maple and twenty cherry ornaments, kit no. W-145B, $89.95 ppd. Heritage Building Specialties, 800/524-4184.

Reindeer in Flight. All the 1/16"-, ⅛"-, ¼"-, and ¾"-thick cherry and maple needed to make the 3-D scene, ⅛" dowel 12" long, 1/16" brass rod 12" long, green aniline dye; kit no. W-145C, $29.95 ppd. Heritage Building Specialties, 800/524-4184.

Glue injector. Taper-point glue injector no. 178-001, $2.99 each. Woodworker's Supply, 800/645-9292.

The *WOOD*® magazine guide to finishing

PART 4

rubbing out a finish

Use fine abrasives to give your projects the professional look.

THE LATEST INSTALLMENT OF A START-TO-FINISH SERIES

We covered wood preparation in issue 139, staining in issue 140, and clear topcoats in issue 142. Now you can fine-tune the final clear coat to perfection with the tips shown here.

You used the right finishing products and techniques, you've put the final coat of finish on your project, and you like the way it looks. What next? Maybe nothing; in some cases, it's time to carry your project out of the shop and share it with the world. However, the chances are pretty good that you didn't end up with an absolutely perfect finish on that last coat. On closer inspection with our eyes and fingers, most of us can find dust nibs, brush marks, orange peel from spraying, or just a general roughness to the surface.

Make those imperfections disappear by rubbing out the finish. What is rubbing out? It's the use of fine abrasives to smooth the finish and fine-tune its sheen. When you rub, you take control of the all-important final coat, just as you controlled the shaping and smoothing of the wood underneath. We can't offer you a surface to touch, but you can see the difference rubbing makes by comparing **Photos A** and **B**.

You can rub virtually any surface, but we suggest sticking to highly visible, often-touched areas, such as tabletops and doors, for your first efforts. The rubbing is easier and the rewards greater.

It's not uncommon to see orange peel in a sprayed finish, as shown at left. After rubbing, you wind up with the smooth, glowing surface at right.

We found rubbing compounds at an auto parts store, got the lamb's wool pad at a home center, ordered the felt block from WoodFinishingSupplies.com, and bought sandpaper, Abralon pads, and nonwoven abrasive pads at a Woodcraft store.

Patience is a virtue

The first requirement for rubbing out is a finish that's thick enough to be worked without wearing through. This usually calls for several thin coats, properly applied. Next, you need patience. Let the finish dry thoroughly before you do any rubbing, and remember that you can't rub to a high gloss until the finish has completely cured. Depending on the finish, temperature, and humidity, curing can take as long as a month.

When you intend to develop a high-gloss finish, it's especially important to start with a super-smooth wood surface. Fill the pores and grain by using a paste filler or wet-sanding your finish, as discussed in issue 139. (For a reprint of that article, or others in the series, send $5 per article to WOOD® Article Reprint Service, P.O. Box 349, Kalona, IA 52247, with a check or money order made payable to *WOOD* magazine. Include the issue number and the name of the article.)

You also need the right rubbing materials, such as those shown in **Photo C**. All of the abrasive products create scratches in the film surface, and the size of the scratches affects the reflection of light, as shown in **Drawing 1**. Finer abrasives create smaller scratches and higher sheens. Coarser abrasives create larger scratches and lower sheens.

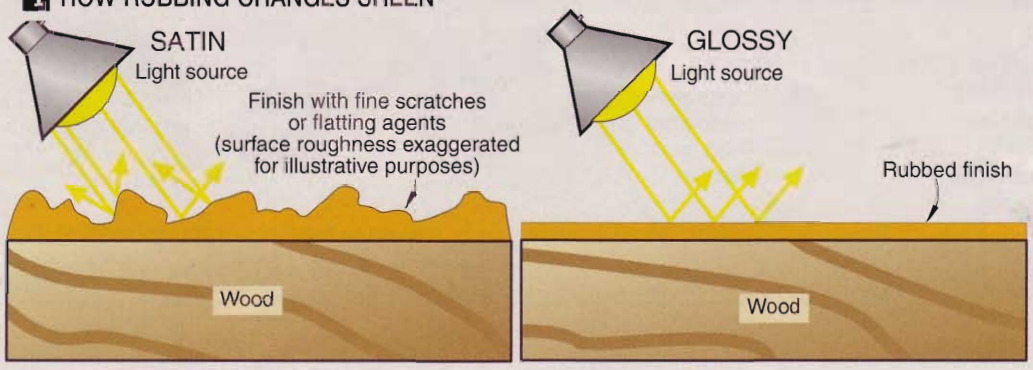
A gloss finish is like optically perfect glass, reflecting light directly back at you. Any finish other than gloss contains flatting agents in the form of tiny silica chips. These agents create a random reflection of light, which produces a softer, less shiny look.

You can lower the sheen of a film finish, but you can't take it to a higher sheen than you started with. For example, a semigloss finish can be rubbed down to a satin or flat sheen but cannot be polished up beyond semigloss.

A high-gloss finish offers more choices. You can take it down to any lesser sheen, including dead flat. If you decide that you've gone too far, you can polish it back up, returning all the way to a high gloss, if you choose. Note, however, that lower sheens tend to minimize flaws while higher sheens exaggerate them.

You need a hard, brittle finish, such as lacquer or shellac, to attain a high gloss. Varnishes and water-based products tend to cure softer and generally do not polish to

1 HOW RUBBING CHANGES SHEEN



D

Small scratches showed in this walnut table finished with an oil/varnish mix, so we rubbed it with an abrasive pad, using dark brown wax from Briwax. (Item number 85C28 in the Woodcraft catalog, priced at $12.50; call 800/225-1153 to order.)

E

Sanding lacquer with fine wet/dry sandpaper and no lubricant turns the top layer of finish into a white, powdery dust. Change paper often to avoid scratches from corning. When you're done with this step, clean the surface with a rag or a blast of air.

much higher than semigloss. With oils and oil/varnish mixes, you're limited to satin.

Sometimes it's simple

Let's start with the simplest form of rubbing out: applying a coat of paste wax to an oil/varnish mix. Once the finish has cured, use a white nonwoven abrasive pad to wipe on wax that contains both soft beeswax and the harder carnauba wax, as shown in **Photo D**. When you're finishing light-colored wood, try Trewax Indian Sand. You can buy a one-pound container at www.wellspent.org for $10.28, plus $7.83 for shipping.

As you rub, you round over any dust nibs in the finish, giving the surface a smooth feel. You run little risk of cutting through the finish as you give the surface a soft, satin glow.

A film finish—varnish, lacquer, or shellac—usually contains more flaws than an oil/varnish mix. The likely culprits include dust nibs, brush marks, bubbles, drag marks, and runs.

When the problems are minimal, rubbing out can be as easy as the process just described. Doing this to a film finish introduces microscopic scratches to the surface that create a satin sheen. Open pores, raised areas, and other flaws remain, but the satin sheen makes them less obvious. You can substitute mineral spirits, soap, or any other lubricant in place of the wax, but it's nice to correct flaws and apply wax at the same time.

More flaws? More steps

Now let's tackle a thicker finish with a few more flaws. The most common flaws—especially with varnish, which dries quite slowly—are dust nibs in the surface. Use the blade from a utility knife to eliminate most of them after each coat dries. Hold the blade between your thumb and forefinger, nearly vertical, and gently scrape the surface with a pulling motion. Be very gentle and avoid putting any blade marks in the finish. You can sand out these nibs, but the blade method lets you work faster and with less effort on flat surfaces. Curved or decorative areas require sanding.

Scraping also eliminates the risk of sanding through the finish at the edges of flat surfaces. Finishes tend to pull away from any edge and flow toward the center, leaving the coating significantly thinner along the edges and making sand-throughs more likely. Spraying a finish can compensate for this by building up the edges, but it's difficult to build a smooth, feathered edge when applying a brushed or wiped finish.

After scraping you still need to sand to get a level surface and eliminate any other flaws. Speed up the process by sanding the finish level midway through the application of finish coats.

Silicon carbide paper wrapped onto a block covered with felt, cork, or rubber works best for leveling, as shown in **Photo E**. If you want to sand dry, stearated silicon carbide paper (usually gray) is generally a good choice. Stearated paper contains a soaplike material that keeps the paper from clogging.

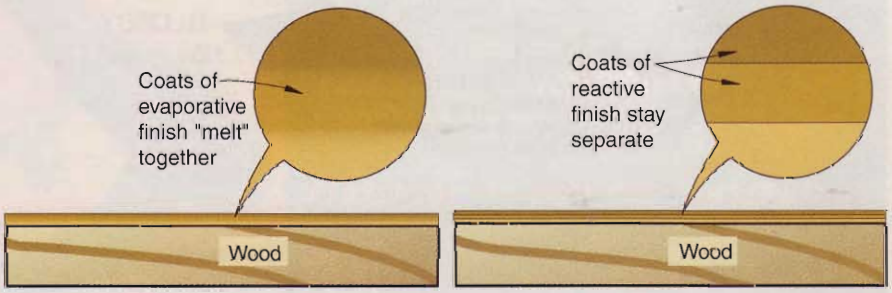
However, you're better off using non-stearated wet/dry 600-grit paper (which is usually black) with water-based finish

F

When you don't have much finish to work with, it's all too easy to rub through it and expose the bare wood, as shown here on a handheld mirror.

2 EVAPORATIVE AND REACTIVE FINISHES

Each new coat of an evaporative finish, such as lacquer and shellac, fuses into the previous one, so rubbing is simple. Reactive finishes, such as varnish, dry in layers; rubbing through one layer into another can create unattractive, irregular lines.



or polyurethane varnish. Also, use nonstearated paper whenever you plan to add more finish.

If you prefer to use a lubricant when sanding a finish, rely on nonstearated paper. Lubricants help to float away the particles that cause corning, the formation of small, hard balls of finish on the paper. Corning can create visible scratches in the finish.

Your lubricant choices with wet/dry paper include water with a bit of soap, paint thinner/mineral spirits, naphtha, wax, and oil. Experiment with them to get a feel for their characteristics. You'll find that soapy water allows the fastest cutting, but also the greatest level of corning. Oil slows the cutting, but allows the least corning.

Faster cutting sounds like a time-saver, but it easily can lead to sand-throughs, like the one shown in **Photo F**. All lubricants tend to disguise sand-throughs. You might go through the finish and not even realize it until the lubricant dries, creating damage that's hard to fix.

To achieve an even surface, sand lightly, clean it, and shine a bright light on it. If you see shiny spots, the surface isn't level. Continue sanding the entire surface, not just the shiny spots.

Each coat of an evaporative finish—such as lacquer and shellac—softens the previous coat, creating a bond that amalgamates into essentially one coat, as shown in **Drawing 2**. However, each coat of a reactive finish—varnishes and some water-based products—dries as a separate layer, which can create problems in sanding and polishing. If you sand unevenly, you might cut through one layer into another, resulting in irregular shapes with white edges.

Once you've leveled the surface so that it feels good to the touch, and looks good, apply a coat of paste wax. Use an abrasive pad as described previously.

Keep going for gloss

When you want to put a high gloss on a lacquer or shellac finish, begin by leveling it as discussed previously. Then continue rubbing with finer abrasives until you're satisfied with the appearance. You can use sandpaper in the 800- to 1,500-grit range, a mix of papers and compounds, compounds alone, or "micro meshes," which range up to an amazing 12,000 grit.

Rubbing and polishing compounds labeled for woodworking or automotive care are easy to find, and do a great job on wood finishes. Most rubbing compounds are orange, and produce a satin finish. Follow with a white polishing compound to attain a glossier look.

You can apply these materials by hand or with a machine. A felt block or a floor finish application pad with a short nap works great for applying rubbing compounds. A lamb's wool pad works well for buffing with polishing compounds, as shown in **Photo G**. Stop by the hardware store, and pick up a lamb's wool applicator designed for floor finishes.

Save time on large, flat surfaces by using a dedicated buffing machine or your random-orbit sander. Many random-orbit sanders have optional heads for rubbing and polishing—check your owner's manual. Take care not to polish through the finish, exposing bare wood, or to build up excessive heat, which can destroy almost any finish.

Finally, apply a well-buffed coat of quality paste wax. This coating protects your finish against wear.

A lamb's wool applicator like the one shown here gives you room to grip with two hands and apply pressure as you rub. The rubbing agent being used on this tabletop is a fine automotive compound.

Written by **Jim Kull** with **Jim Pollock**
Photographs: **Marty Baldwin; Hetherington Photography**
Illustrations: **Roxanne LeMoine**

Sources for rubbing supplies

Can't find what you need at the hardware store or home center? Here are a couple of outlets for the good stuff.

•Woodcraft: Sandpaper, abrasive pads, micro-mesh sanding kit, random-orbit buffing pads, paste wax. Call 800/225-1153 to request a catalog, or go to www.woodcraft.com.

•WoodFinishingSupplies.com: Sandpaper, abrasive pads, random-orbit Abralon pads, felt rubbing block, paste wax. Log on to www.woodfinishingsupplies.com.

RUBBING BASICS

FINISH TYPE	LEVELING	FLAT OR SATIN SHEEN	GLOSS
Oil or oil/varnish	320-grit wet/dry sandpaper, using finish as lubricant	Buff with white abrasive pad and paste wax	Not possible
Polyurethane varnish, spar varnish, water-based finishes	600-grit wet/dry sandpaper or white abrasive pad on random-orbit sander	Buff with rubbing compound, or white abrasive pad and paste wax	Not recommended
Lacquer and shellac	600-grit wet/dry sandpaper or white abrasive pad on random-orbit sander	Buff with rubbing compound, or white abrasive pad and paste wax	After reaching satin sheen, rub with fine polishing compound or 800- to 1,500-grit sandpaper

Corner or straight bench: it's your choice

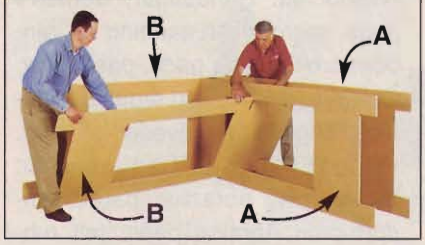
This article shows you how to make the corner bench shown at *left*. If you prefer a straight bench (see *above*) follow the same instructions but make two right bases (A), two ends (C), and the long top (D). Omit the biscuit slots in (D). Use the cutouts from the right bases (A) to make two long base shelves (F). Fit your straight bench with optional shelves at each end by making the long and short cleats (H, I) and the long and short shelves (J, K) from the extra particleboard.

One-day Workbench

cheap as dirt, solid as a rock

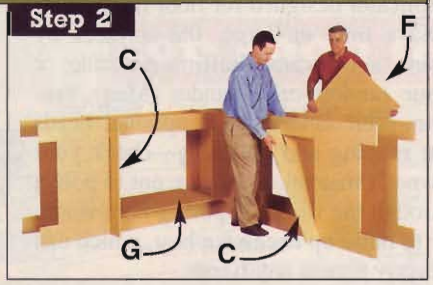
With a helper, assembly is a snap

Step 1



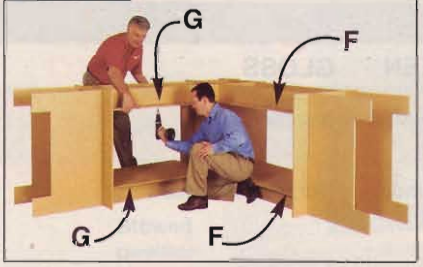
Interlock the slots in the left bases (B) with the right bases (A).

Step 2



Interlock the slots in the ends (C) with the bases. Add the lower base shelves (F, G).

Step 3



Drill pilot holes, and screw the upper base shelves (F, G) in place.

Step 4

Position the long and short tops (D, E). Drill pilot holes, and screw them in place.

For the items needed to build this project, see the Materials List and Cutting Diagram on *page 86*.

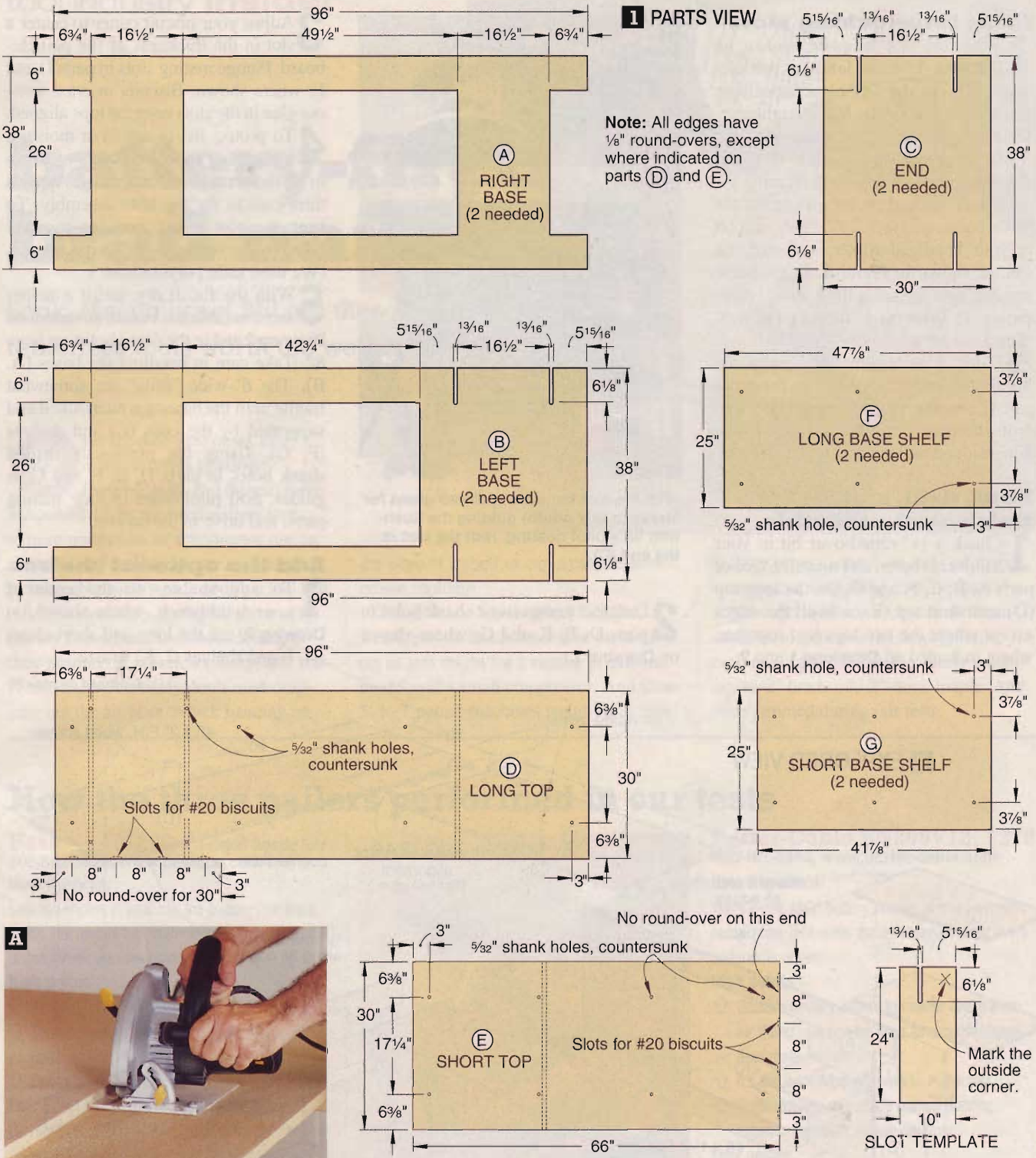
Inexpensive material and two readers' ingenious design work together in this sturdy bench project that's a cinch to build.

Cut out the bench parts

1 Temporarily fasten 4'-long 2×4 extensions to a pair of sawhorses, and lay a sheet of ¾" particleboard across them. The extensions will support both the workbench parts and the cutoffs as you work. Referring to the Materials List, mark the width of the right base (A) on the sheet.

2 Measure the distance from the right edge of your portable circular saw's shoe to the right side of the blade. Lay a second sheet of particleboard on the first, offsetting it from part A's marked width the distance you measured on your saw. Clamp the second sheet to the first, and cut part A to width, as shown in **Photo A**.

3 Using the cutoff from the first part A as a straightedge, clamp it to the other



A

Using the edge of a second sheet to guide your saw, cut the first part A to width. Save the cutoff for a straightedge for cutting the other parts.

sheets, offsetting it your measured distance from the parts' dimensions. Cut the rest of the parts A, B, C, D, and E to size.

4 Lay out the end and center cutouts on the right bases (A) and left bases (B), where shown on **Drawing 1**. Drill blade-start holes and jigsaw the cutouts, or see the shop tip on *page 86* on making inside cuts with your circular saw.

5 True up one edge of the four base center cutouts. Cut the upper and lower long base shelves (F) from the cutouts from the right bases (A), and the upper and lower short base shelves (G) from the cutouts from the left bases (B).

Form interlocking slots

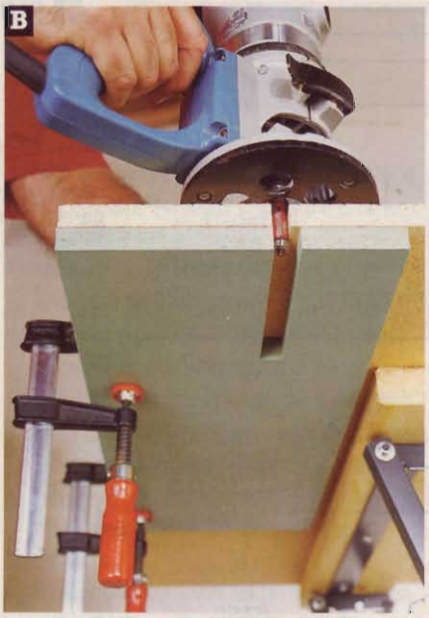
1 Make the slot template, shown on **Drawing 1**, from leftover particleboard. To cut the slot as accurately as possible, use a jigsaw and straightedge. Mark the outside corner, where shown.

2 Retrieve one of the ends (C), and clamp the template to it, aligning the template's marked corner with one of the part's corners. Chuck a ½" flush-trim bit in your handheld router, and rout the slot, as shown in **Photo B**. In the same manner, rout the other three slots, where shown on **Drawing 1**, flipping the template as needed.

3 Using it as a template, clamp the slotted end (C) in turn to the other part C and the two left bases (B), and rout the slots in those parts, where dimensioned on **Drawing 1**.

Rout, drill, slot, finish, and assemble

1 Chuck a ⅛" round-over bit in your handheld router, and rout all edges of parts A, B, C, F, and G. On the long top (D) and short top (E), rout all the edges *except* where the two tops butt together, where indicated on **Drawings 1** and **2**.



With the slot template (painted green for clarity in this photo) guiding the flush-trim bit's pilot bearing, rout the slot in the end (C).

2 Drill 5/32" countersunk shank holes in parts D, E, F, and G, where shown on **Drawing 1.**

3 Adjust your biscuit cutter to center a slot in the thickness of the particleboard. Plunge mating slots in parts D and E, where shown. Biscuits inserted *without* glue in the slots keep the tops aligned.

4 To protect the bench from moisture and grime, apply two coats of finish to all the parts before assembly. Apply a third coat to the top after assembly. To keep the cost down, you can use any house paint or finish you have around. (We used satin polyurethane.)

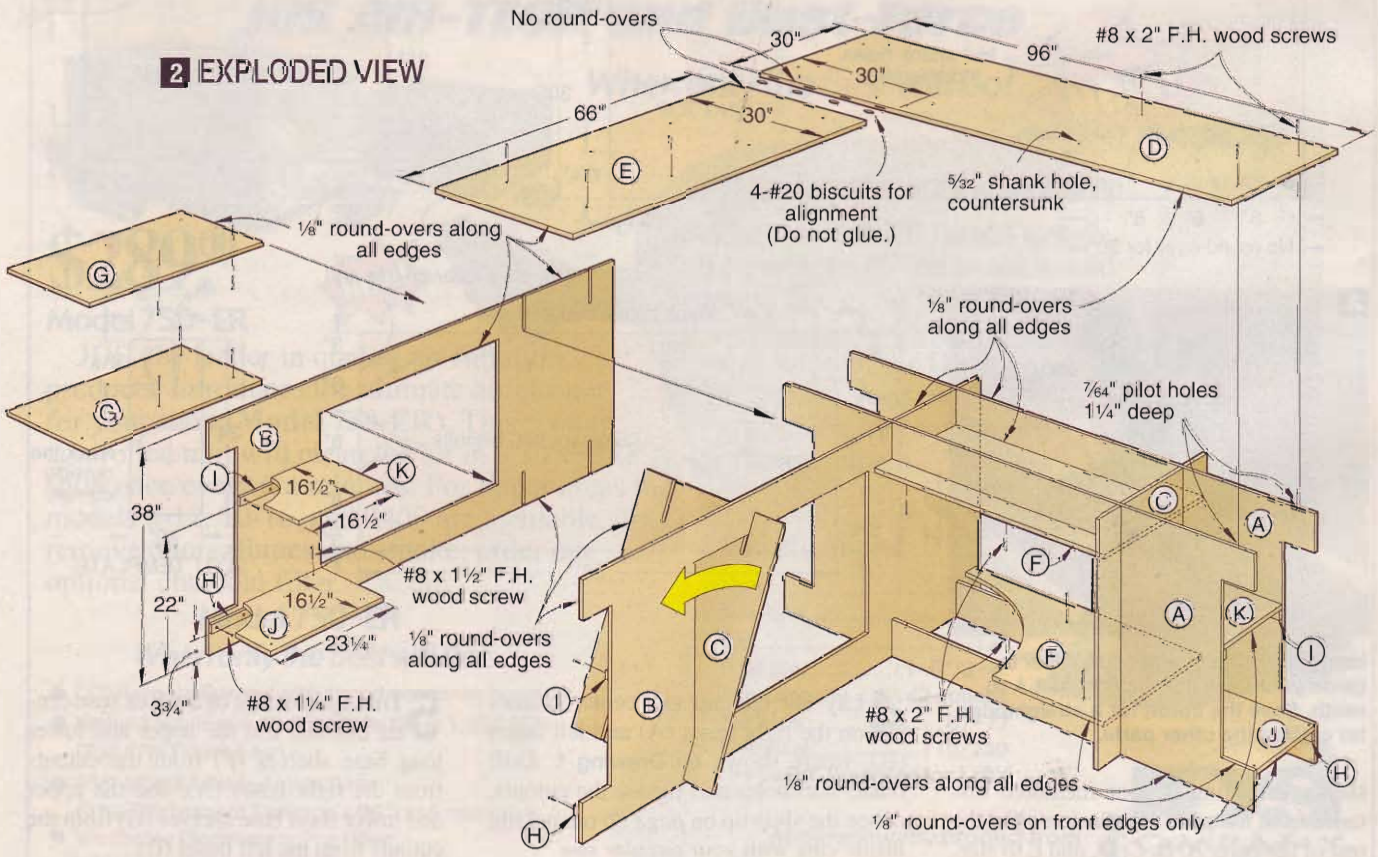
5 With the finish dry, enlist a helper and assemble the bench, as shown on **Drawing 2** and in the four photos on *page 82*. Take care in handling the bases (A, B). The 6"-wide "rails" are somewhat fragile until the bases are interlocked and supported by the ends (C) and shelves (F, G). Using the previously drilled shank holes in parts D, E, F, and G as guides, drill pilot holes in their mating parts, and drive in the screws.

Add the optional shelves

1 To add shelves to the ends of your workbench, where shown on **Drawing 2**, cut the long and short cleats (H, I) and shelves (J, K) to size.

Continued on page86

2 EXPLODED VIEW



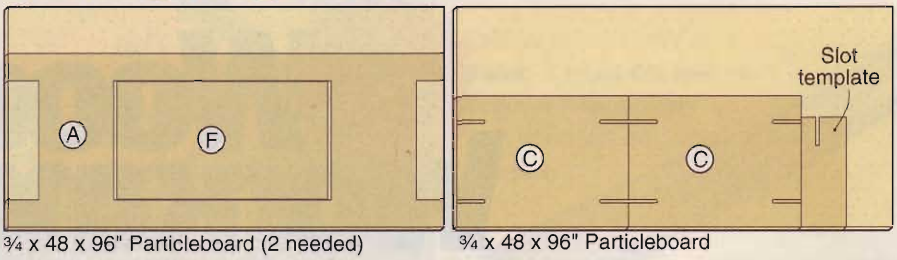
Meet the designers

Chad Veach, *above left*, a professional engineer, and Cameron Campbell, an architect teaching at Iowa State University, collaborated on this entry for Best Original Workbench Design in *WOOD®* magazine's Great American Workshops Contest.

By replacing legs with interlocking panels, their design eliminated the problem of making rigid connections between the benchtop and legs. In the corner configuration, each section reinforces the other, increasing stability. Chad and Cameron also included a continuous overhanging edge for clamping, and shelves deep enough to store large tools or materials.

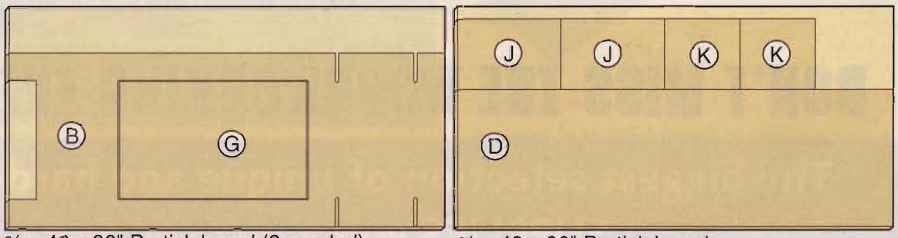
Using only a circular saw, drill, and jigsaw, they built the original bench in half a day.

cutting diagram



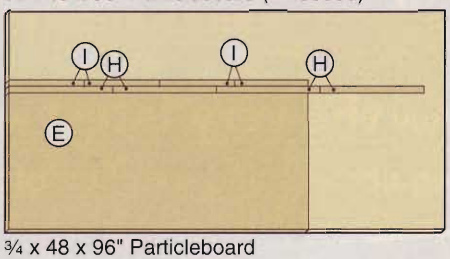
¾ x 48 x 96" Particleboard (2 needed)

¾ x 48 x 96" Particleboard



¾ x 48 x 96" Particleboard (2 needed)

¾ x 48 x 96" Particleboard



¾ x 48 x 96" Particleboard

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A right bases	¾"	38"	96"	P	2
B left bases	¾"	38"	96"	P	2
C ends	¾"	30"	38"	P	2
D long top	¾"	30"	96"	P	1
E short top	¾"	30"	66"	P	1
F long base shelves	¾"	25"	47⅞"	P	2
G short base shelves	¾"	25"	41⅞"	P	2
H long cleats	¾"	1½"	23¼"	P	4
I short cleats	¾"	1½"	16½"	P	4
J long shelves	¾"	16½"	23¼"	P	2
K short shelves	¾"	16½"	16½"	P	2

Material Key: P–particleboard.

Supplies: #8x1¼" flathead wood screws, #8x1½" flathead wood screws, #8x2" flathead wood screws, #20 biscuits.

Router Bits: ½" flush-trim, ⅛" round-over.

2 Rout ⅛" round-overs on the front edges of the shelves. Drill 5/32" countersunk shank holes through the cleats. Locate the holes 1" in from both ends of each cleat, then evenly space two more holes between these. Apply two coats of finish to the shelves and cleats.

3 Using the shank holes in the cleats as guides, drill pilot holes in the bases (A, B), and screw the cleats in place. Position the long cleats so the long shelves are flush with the bottom of the bases' end cutouts. Position the short cleats to accommodate the height of the items you plan to store. You may want to make more than one short shelf for each end. Lay the long shelves on the long cleats. Drill pilot and countersunk shank holes, and screw the long shelves to their cleats. Lay the short shelves in place.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Cameron Campbell** and **Chad Veach**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**
Photographs: **Marty Baldwin**

SHOP TIP

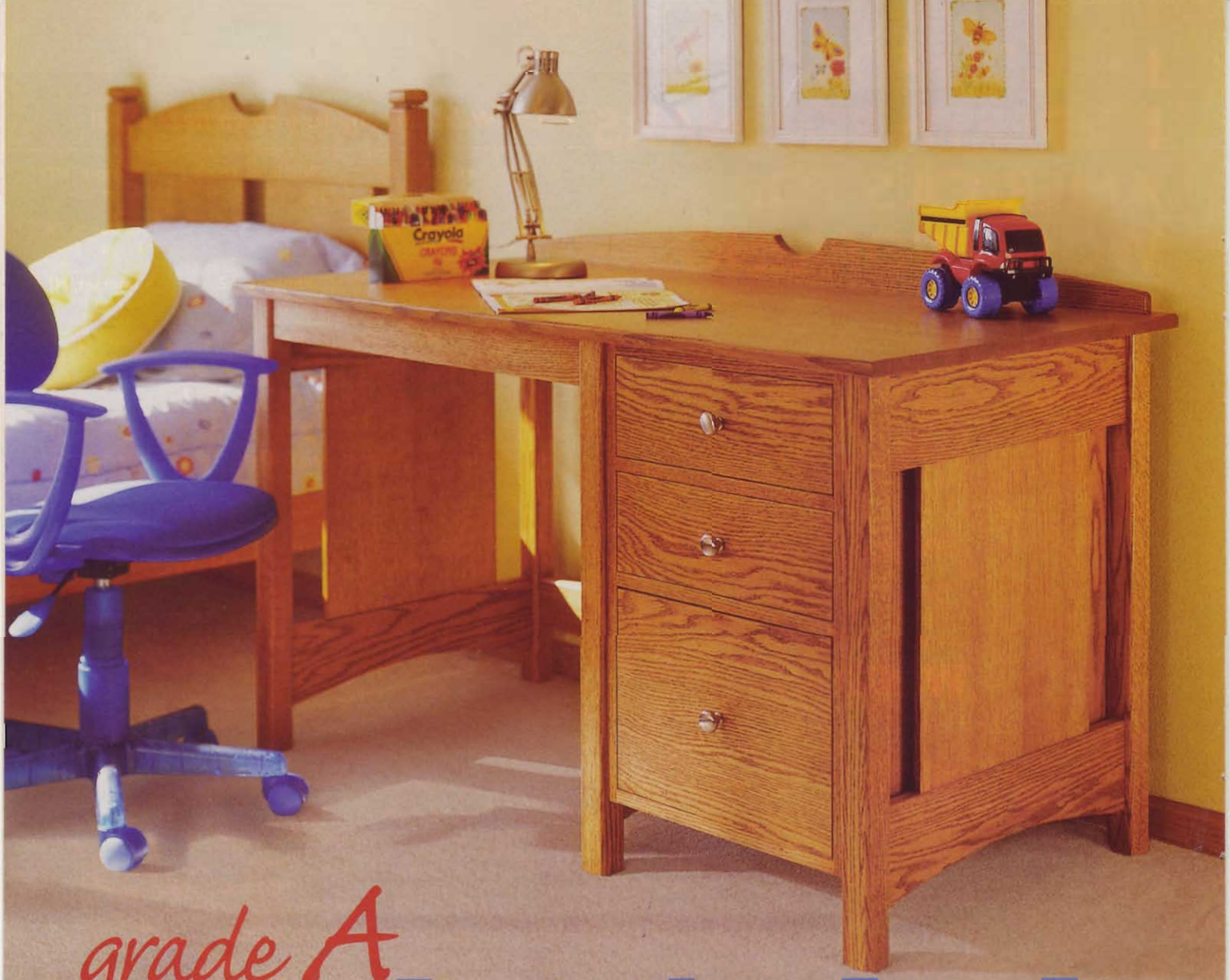
Making inside cuts with a circular saw

To get arrow-straight edges when making inside cuts, like the ones needed to remove the cutouts in the workbench bases, use your circular saw, a straightedge, and a technique called plunge cutting. Here's how.

Measure the offset from the edge of your circular saw's shoe to the side of the blade. Clamp a straightedge to the part, offsetting it that distance from the cutout's layout line. With the saw's depth adjustment loose, raise the blade above the part's surface. Starting at one inside corner, hold the shoe against the straightedge, and swivel the blade guard out of the

way. Switch on the saw, and lower the blade through the part, as shown in the photo, *above*.

Keeping the saw's shoe against the straightedge, continue your cut, stopping at the next corner's intersecting layout line. Repeat with the other three sides of the cutout. Finish the cuts at the corners with a handsaw.



grade A student's desk

This homework assignment teams traditional styling with solid oak.

The last piece of our three-piece children's bedroom ensemble, this desk matches the twin bed and dresser presented in the October 2002 issue, featuring the same handsome looks and sturdy construction. Three drawers offer ample storage for pencils and pens, paper, and books.

For the items needed to build this project, see the Cutting Diagram and Materials List on *page 93*.

Start with the legs.

1 From ¾"-thick stock, planed to ½", cut twelve 1⅞×31" blanks for the outside legs (A). From ¾"-thick stock, cut six blanks of the same size for the inside legs (B). All of the blanks are oversized ⅛" in width and 2" in length. The edges are jointed or ripped and the ends are trimmed after the legs are laminated, where shown on **Drawing 1**.

2 Cut the two notches in the inside legs, where dimensioned, using a bandsaw or a tablesaw fitted with a ¾" dado blade. The notches form mortises in the finished laminated legs.

3 Laminate and assemble the legs (A, B) in the configuration shown on **Drawing 1**, keeping the ends and edges flush. (We used white glue, which has a longer working time, to assemble the legs.) Clamp the legs together with the notches up and the ends and top edges aligned. Remove excess glue from the edges and inside the mortises.

4 Joint or rip 1/16" from two sides of each leg, where shown, for a 1¾"-square lamination. Then, trim the bottom of each leg 2¾" below the lower mortise. Now, trim the top of each leg to the finished length of 29". Finally, rout ¼" round-overs on all edges except the top.

Complete the side-panel parts, and assemble

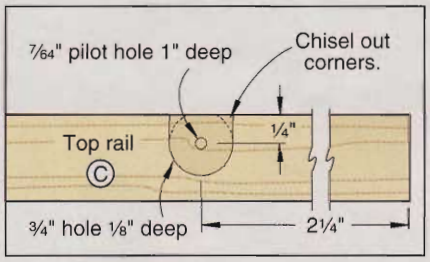
1 Cut the top and bottom rails (C) to the size listed in the Materials List. Then, cut a ½" groove ½" deep, centered in the rails, to receive the panel assemblies (D/E), where shown on **Drawing 1**.

2 Lay out the arch on the three bottom rails, where shown. To do this, first clamp two ¾×1×2" stopblocks to a rail, one at each end of the intended arch, with the stopblocks' bottoms flush with the rail's bottom and their inside edges positioned 1¾" from the ends. Rip a ⅛"-thick wood fairing strip 24" long. Place the strip against the stopblocks, and flex it so its center is 1¼" from the rail's bottom. Mark the arch; then bandsaw and sand smooth. Using this rail as a template, mark the arch on the other two bottom rails. Now, cut and sand them to shape.

3 Using a ¾" Forstner bit, drill two holes ⅛" deep in the top edge of each of the three top rails for the desktop fasteners, where dimensioned on **Drawings 1** and **1a**. Chisel out the corners to allow the top (W) to move. Then, at the centerpoints of the ¾" holes, drill the pilot holes for the mounting screws.

4 From ½" oak plywood, cut the panels (D) to size. From ¼"-thick oak, rip six ⅝×17¼" blanks for the edging (E). Glue the edging to the panels with a 1/16" overhang on each face. After the glue dries, trim the edging flush to the panels. (For an easy way to do this, make the flush-trimming fence in issue 144, page 10.)

1a DESKTOP FASTENER SLOT DETAIL

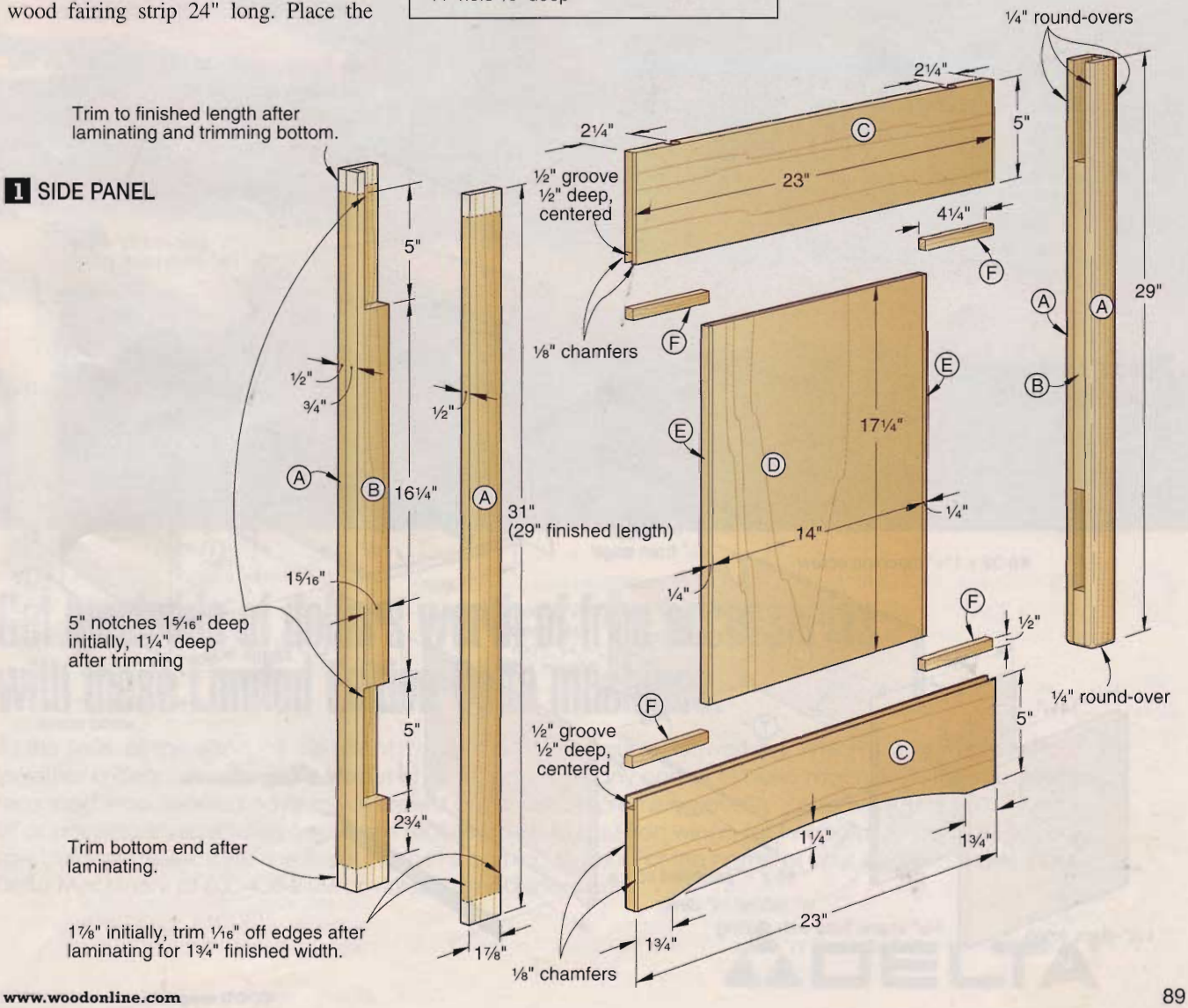


SHOP TIP

Chamfer the edges of parts for easier assembly

To ease insertion of parts into mating pieces and to provide room for glue squeeze-out, chamfer the edges of parts, as shown on the ends of the top and bottom rails (C).

1 SIDE PANEL



With the panel and rail centerlines aligned, glue and clamp spacers in place, tight to the panel and flush with the ends of the rail.

5 Cut a ½×½×54" blank for the spacers (F); then cut them to size. Mark a centerline across the grain on one face of each top and bottom rail. Mark a centerline with the grain on one face of each panel at the top and bottom. Assemble a bottom rail and a panel, and glue spacers in the groove in the rail, as shown in **Photo A**. Clamp the spacers to the rail, remove the panel, and set the rail aside. Repeat to install the spacers in the other bottom and top rails.

6 Apply glue in the grooves in a top and bottom rail and in the mortises in two leg assemblies. Assemble the rails, a panel, and the legs. Clamp the assembly, and check for square. Remove excess glue, and set aside. Repeat to assemble the other two side panels.

Next, build the drawer carcase

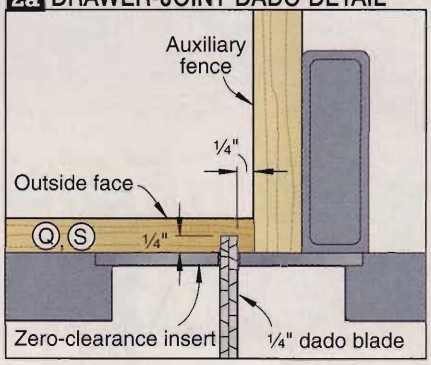
1 From ¾" oak plywood, cut the drawer carcase sides (G) and top and bottom (H) to size.

2 From ¼"-thick oak, cut four ⅞×24⅝" blanks for the side edging (I), and cut four ⅞×14⅞" blanks for the top and bottom edging (J). Glue edging I to the sides, and glue edging J to the top and bottom, and trim flush when dry.

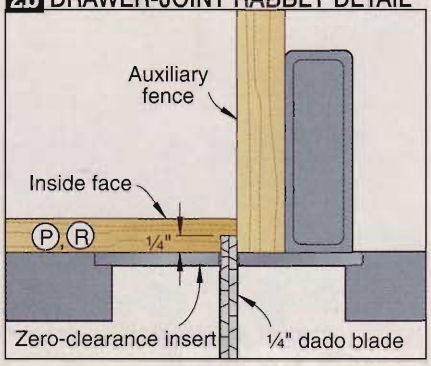
3 Cut a ¼" groove ⅜" deep and ¼" from the back edge in the sides (G) and top and bottom (H) to receive the back (K), where shown on **Drawing 2**. Then, cut the back and the dividers (L) to size.

4 Apply glue in the grooves in the sides, top, and bottom, and assemble the carcase with the back located in the

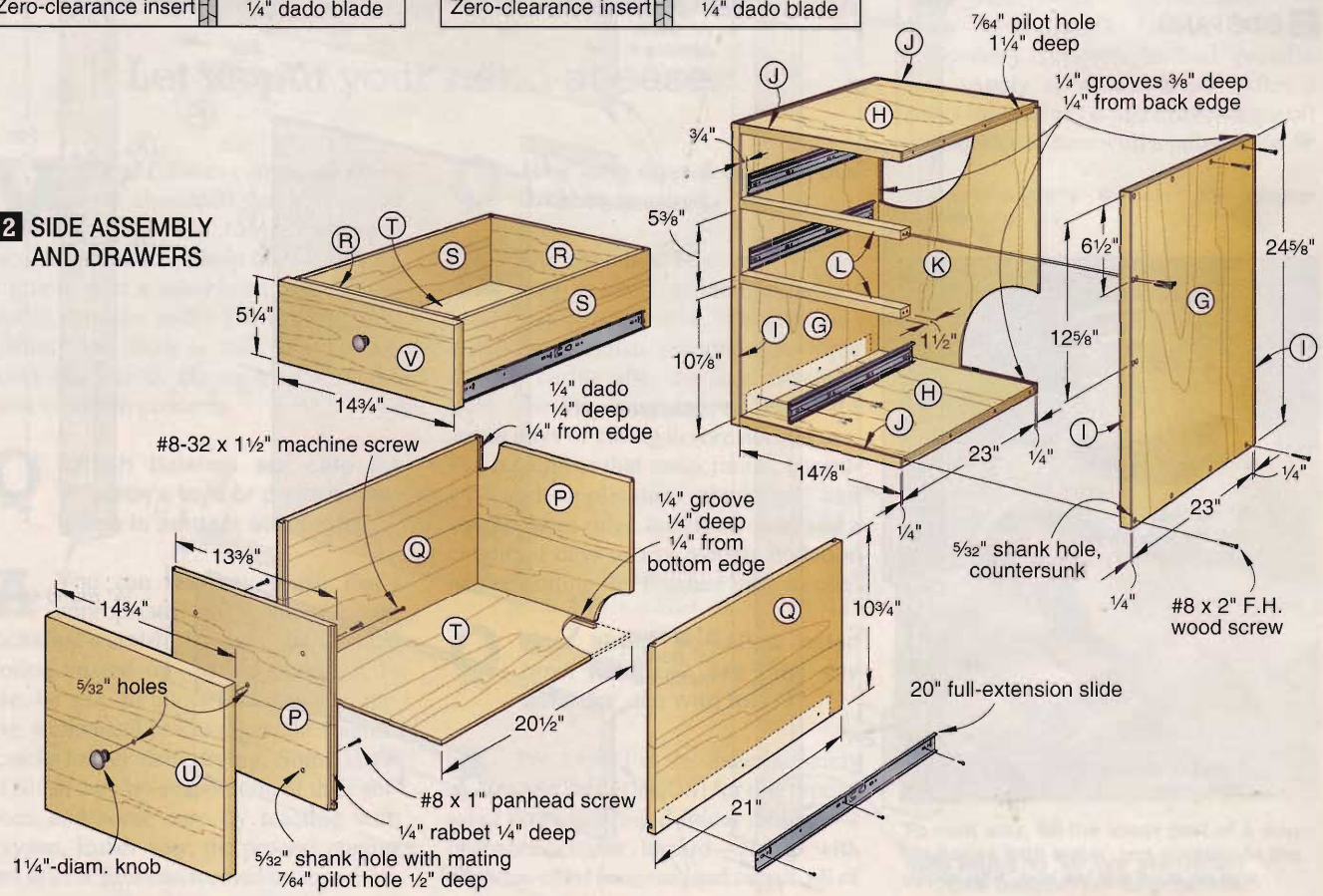
2a DRAWER-JOINT DADO DETAIL

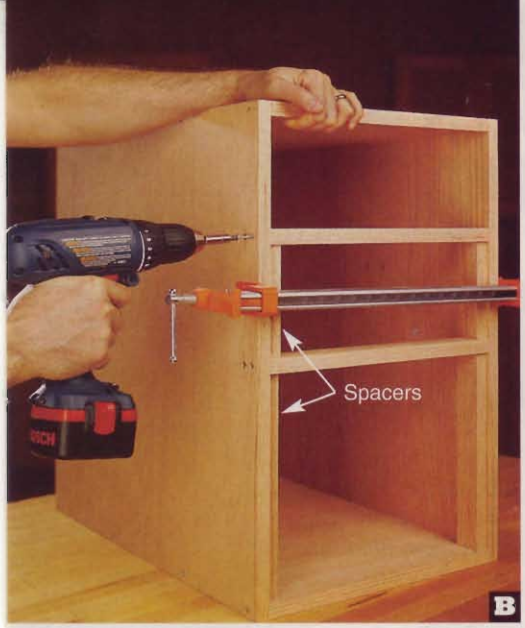


2b DRAWER-JOINT RABBET DETAIL



2 SIDE ASSEMBLY AND DRAWERS





Position the dividers in the carcase, supporting them on the spacers. Clamp the carcase sides to snug the dividers. Drill the holes, and drive in the screws.

Mask mating glue-joint areas along the front and back edges of the carcase sides and on the inside of the side-panel legs with easy-release painters' tape. Then apply the stain.

Clamp the crossrails between the side panel and the drawer carcase. Drive screws through the cleats into the legs to secure.

grooves. Check for square. Then, drill pilot and countersunk shank holes through the sides and into the top and bottom, where shown, and drive in the screws.

5 From ¾"-thick scrap, make a pair of spacers 1½×10⅞" for positioning the lower divider (L) in the carcase and another pair of spacers 1½×5⅜" for positioning the upper divider in the carcase. Position and clamp the spacers and dividers in the carcase, as shown in **Photo B**. Mark screw-hole centerpoints on the outside face of the carcase sides (G) centered over the dividers, where dimensioned on **Drawing 2**. Drill pilot and countersunk shank holes at the centerpoints, and drive in the screws. Remove the spacers.

6 Finish-sand the carcase and the side-panel assemblies to 220 grit, and remove the dust. Mask mating 1"-wide glue-joint areas on the carcase sides and the legs of two side-panel assemblies, where shown in **Photo C**. Now, stain the inside of the side-panel assemblies; the outside of the carcase sides and back (K); the front edges of the carcase; the dividers (L); and a 1"-wide area around the inside of the carcase at the front edge. (We used ZAR Provincial stain.)

7 With the stain dry, remove the tape. Position the carcase upside down on your workbench, and apply glue to the previously masked areas. Now, mate the side-panel assemblies to the carcase with the top edges flush and a ¼" leg reveal at the front and back. Then, clamp the assembly.

Add the crossrails, and assemble the desk

1 From ¾"-thick stock, cut the cap (M) to size. From ½"-thick stock, cut the crossrails (N) to size. Glue the cap to the top of the crossrail that will go at the bottom of the desk with their front faces flush. Now, rout ¼" roundovers on the cap's top edges and on the lower front edge of the crossrail that will go at the front of the desk, where shown on **Drawing 3**.

2 Cut the cleats (O) to size. Position the cleats on the ends of the crossrails, where shown, and clamp. Drill pilot and countersunk shank holes, where shown; then, glue and screw the cleats in place.

3 Assemble the crossrails, the remaining side panel, and the drawer carcase, as shown in **Photo D**. Position the crossrails with a ¼" leg reveal at the front and back. Also, position the cap/crossrail assembly (M/N/O) so the cap is flush with the top edge of the bottom rails (C). Then, drill pilot and countersunk shank holes through the cleats and into the legs, where shown, and drive in the screws.

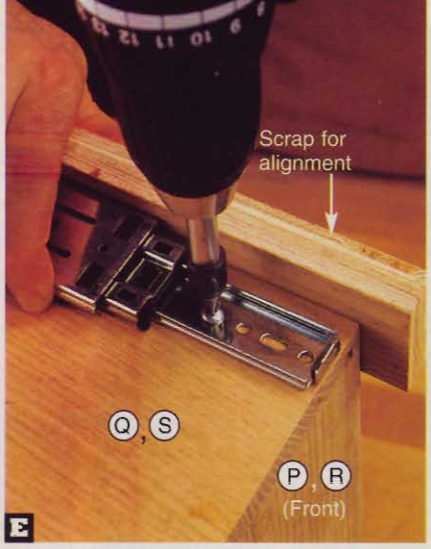
Make the drawers

1 Edge-join enough ¾"-thick stock for the front and back (P) and the sides (Q) for the bottom file drawer. Plane to ½" thick; then cut the parts to size. From ¾"-thick stock, planed to ½", cut the fronts and backs (R) and the sides (S) for the upper drawers to size.

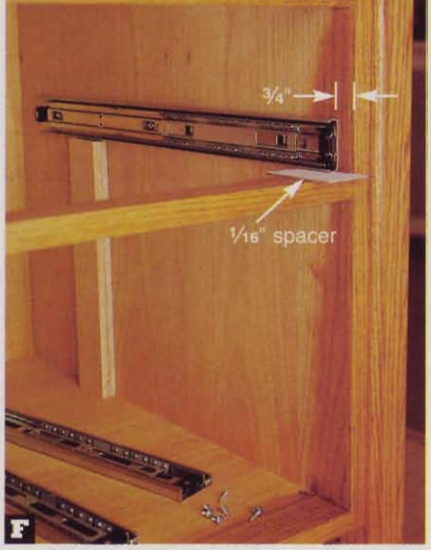
2 Cut a ¼" dado ¼" deep and ¼" from the ends of the sides (Q, S) on their inside faces, where shown on **Drawing 2**. See **Drawing 2a** for the setup we used. Using the setup shown on **Drawing 2b**, cut a ¼" rabbet ¼" deep along the ends of the fronts and backs (P, R) on their outside faces. Finally, cut a ¼" groove ¼" deep and ¼" from the bottom edge of the sides and the fronts and backs to receive the bottoms (T). Cut the bottoms to size. Now, glue, assemble and clamp the large and small drawers, and check for square.

3 Position the full-extension slides on the drawer sides, as shown in **Photo E**, and attach with the supplied screws. Then, disconnect the larger cabinet-member part of the slides from the drawer member.

4 Install the cabinet-member part of the slides in the drawer carcase, working from top to bottom. To do this, first measure from the top of the carcase bottom (H) to the top of the upper divider (L). From ¾"-thick scrap, cut a 2"-wide spacer to your measured length plus 1/16". Also, make two 1×2" spacers 1/16" thick from cardstock or plastic laminate, and set one spacer aside. Position a slide in the carcase, where shown in **Photo F**, and drive in the screws. (Note that the photo shows installation of a slide for the middle drawer with the



Place a slide on a drawer side flush with the bottom and front edges. You'll need to open the slide a little to drive in the screws.



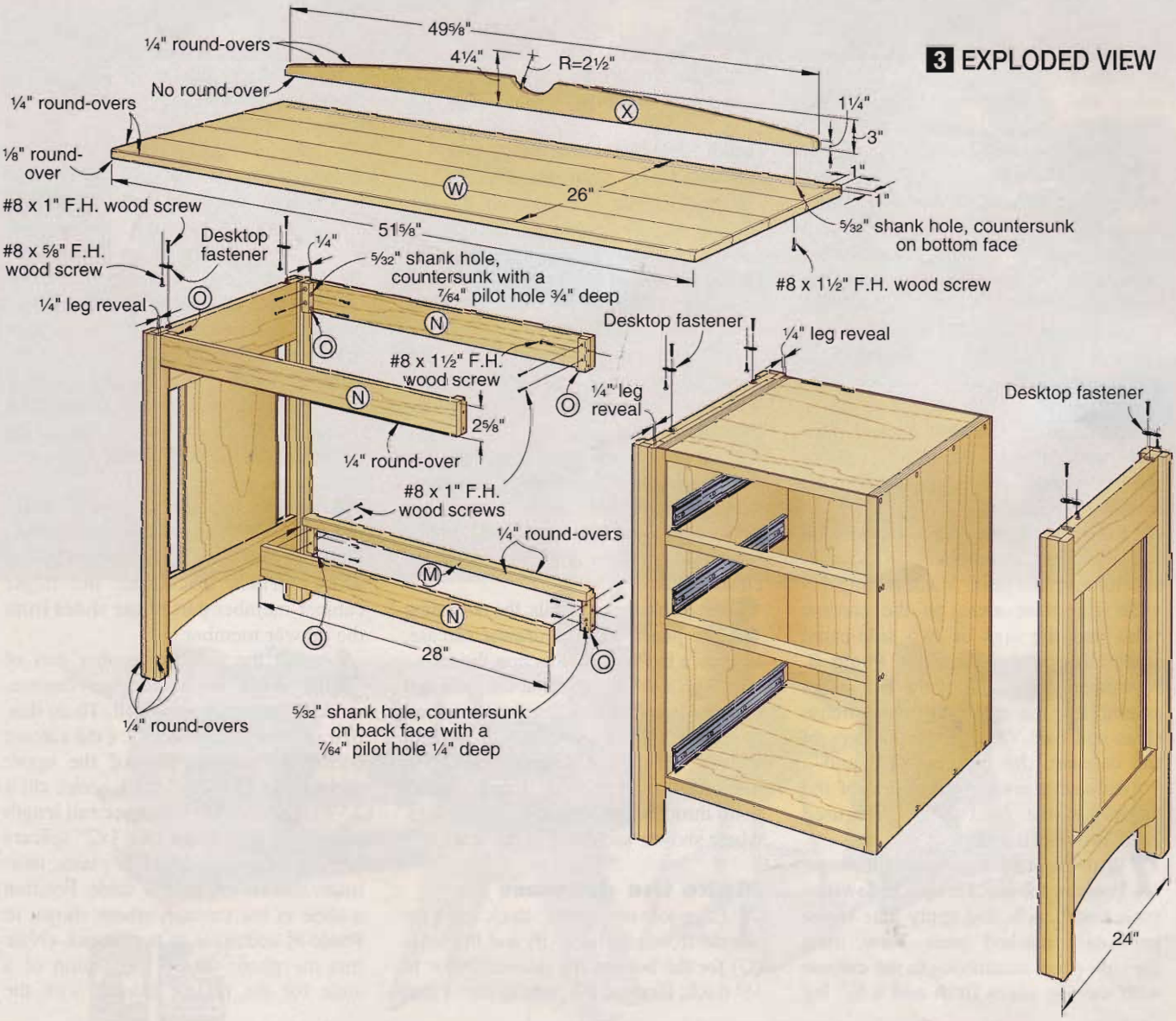
Locate the cabinet-member part of a slide ¾" back from the front of the carcase while supported on the wood spacer at the rear and 1/16"-thick spacer at the front.

wood spacer trimmed accordingly.) Repeat to install a slide on the opposite side. Then, repeat the process, trimming the spacer as necessary, to install the next-lower pair of slides. Install the slides at the bottom of the carcase by setting them on the two 1/16"-thick spacers. Now, install the drawers.

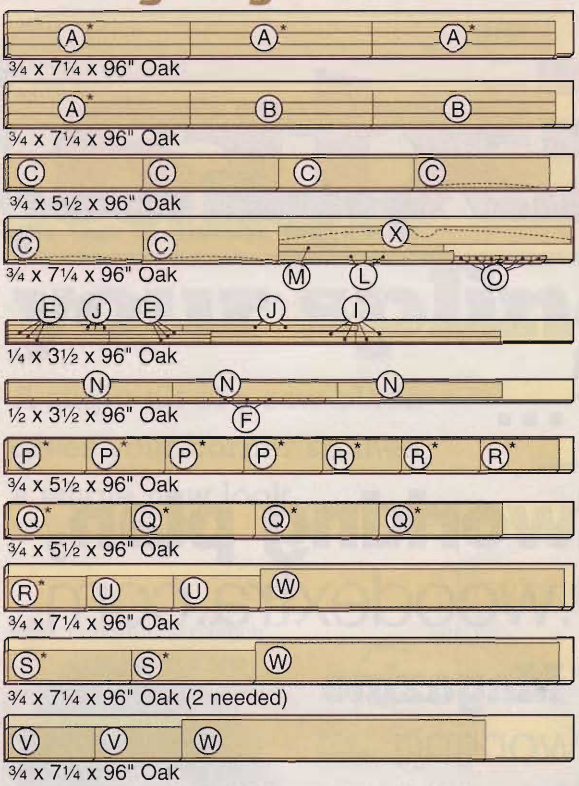
5 Edge-join enough ¾"-thick stock for the bottom drawer face (U); then cut it to size. Also, cut the upper drawer faces (V) to size. Apply double-faced tape to the drawer fronts (P, R). Center the faces in the carcase openings, and press them onto the taped fronts. Now, carefully pull out a drawer and clamp the face and front. Drill holes from inside the drawer, where shown on

Continued on page 94

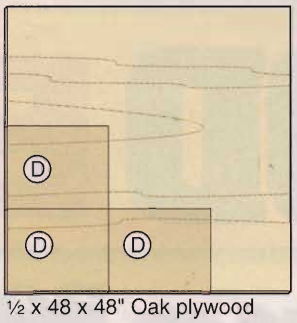
3 EXPLODED VIEW

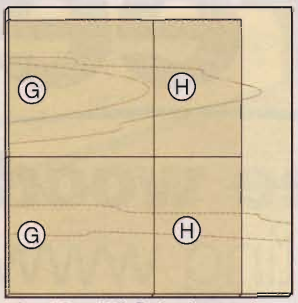


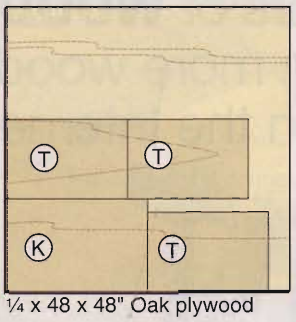
cutting diagram


¾ x 7¼ x 96" Oak
¾ x 7¼ x 96" Oak
¾ x 5½ x 96" Oak
¾ x 7¼ x 96" Oak
¼ x 3½ x 96" Oak
½ x 3½ x 96" Oak
¾ x 5½ x 96" Oak
¾ x 5½ x 96" Oak
¾ x 7¼ x 96" Oak
¾ x 7¼ x 96" Oak (2 needed)
¾ x 7¼ x 96" Oak

*Plane or resaw to the thickness listed in the Materials List.







materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
Side panels					
A* outside legs	½"	1¾"	29"	O	12
B* inside legs	¾"	1¾"	29"	O	6
C top and bottom rails	¾"	5"	23"	O	6
D panels	½"	14"	17¼"	OP	3
E* edging	¼"	½"	17¼"	O	6
F* spacers	½"	½"	4¼"	O	12
Drawer carcase					
G sides	¾"	23"	24⅝"	OP	2
H top and bottom	¾"	23"	14⅞"	OP	2
I* side edging	¼"	¾"	24⅝"	O	4
J* top and bottom edging	¼"	¾"	14⅞"	O	4
K back	¼"	15⅝"	23⅞"	OP	1
L dividers	¾"	1½"	14⅞"	O	2
Crossrails					
M cap	¾"	1¼"	28"	O	1
N crossrails	½"	2⅝"	28"	O	3
O cleats	¾"	¾"	2⅝"	O	6
Drawers					
P* front and back	½"	10¾"	13⅜"	EO	2
Q* sides	½"	10¾"	21"	EO	2
R fronts and backs	½"	5¼"	13⅜"	O	4
S sides	½"	5¼"	21"	O	4
T bottoms	¼"	13⅜"	20½"	OP	3
U* face	¾"	10¾"	14¾"	EO	1
V faces	¾"	5¼"	14¾"	O	2
Top assembly					
W* top	¾"	26"	51⅝"	EO	1
X crest	¾"	3"	49⅝"	O	1

*Parts initially cut oversize. See the instructions.

Materials Key: O–oak, OP–oak plywood, EO–edge-joined oak.

Supplies: #8x⅝", #8x1", #8x1½", and #8x2" flathead wood screws; #8x1" panhead screws; white glue; easy-release painters' tape.

Blades and Bits: Dado blade, chamfer bit, ¾" Forstner bit, flush-trim bit, ¼" round-over bit, ⅛" round-over bit.

Buying Guide

Hardware. Desktop fasteners, no. KV1547 (6); 1¼"-diam. solid-brass knobs with satin chrome finish, no. A01950 G10 (3) with #8-32x1½" machine screws; 20" full-extension slides, no. KV8400 B20 (3 pr.) with screws. Order kit no. KIT1102, $49.95 ppd., from Woodworker's Hardware. Call 800/383-0130 or go to www.wwhardware.com.

Drawing 2, and drive the screws into the face. Drill a hole for the knob screw, where shown. Repeat for the remaining drawers.

Note: We found it easiest to stain the drawer faces (U, V) before installing them.

Top it off

1 Edge-join enough ¾"-thick stock for the top (W), and cut to size. Rout a ¼" round-over on the top edges and a ⅛" round-over on the bottom edges, where shown on **Drawing 3**.

2 Cut the crest (X) to size. Mark the arch on the crest, where shown. (Use the technique that you used to mark the arch on the bottom rails, except you'll need a 54"-long fairing strip.) Using a compass, mark the 2½" radius in the center of the crest, where dimensioned. Bandsaw the top of the crest to shape, and sand to remove saw marks. Now, rout ¼" round-overs along the top edges and ends, where shown.

3 Position the crest on the top, where shown. Drill pilot and countersunk shank holes through the top into the crest, and drive in the screws.

Note: We found it easiest to stain the top assembly (W/X) before attaching it.

4 Screw the large end of the desktop fasteners to the top rails (C) with #8x1" flathead wood screws. Center the top assembly (W/X) on the desk, and drive the #8x⅝" flathead wood screws through the small end of the fasteners into the bottom side of the top.

Finish up

1 Finish-sand any parts not previously sanded to 220 grit. Remove the dust. Then, apply stain to these parts and to the unfinished surfaces of the side-panel assemblies.

2 Finally, apply two coats of a clear finish on all stained areas, sanding between coats. (We brushed on polyurethane.) Then, install the drawer knobs with 1½" machine screws.

Written by **Owen Duvall** Project design: **Kevin Boyle** Illustrations: **Roxanne LeMoine; Lorna Johnson** Photographs: **Marty Baldwin**

shop-proven products

These woodworking wares passed our shop trials

This portable planer eats its own dust

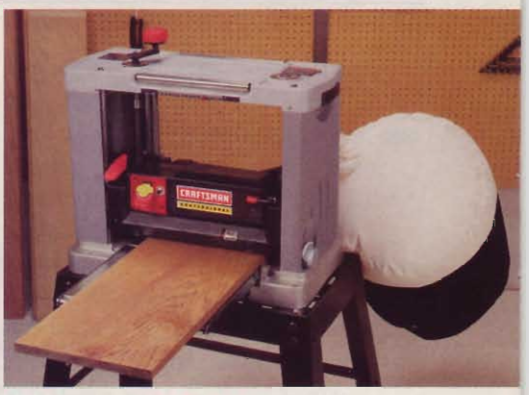
A portable planer is one of the messiest tools in the workshop, generating mounds of wood chips in minutes. Even if you have a dust collector attached, it can rapidly fill with debris. Craftsman's 21743 13" Portable Planer gives woodworkers an outstanding alternative, whether or not you already have a dust collector.

An impeller on the planer extracts chips from the cutterhead, funnels them through a breathable half bag (the white piece in the photo, at *right*), then dumps them directly into a trash can or garbage bag for carry-to-the-curb disposal. Some chips still escape out the back of the machine, but the system works well. In my tests, I generated enough waste to fill a 20-gallon trash can, while only about 1½ quarts of the stuff ended up on the floor.

And the 21743 offers other timesaving features as well. For instance, the motor-assisted elevation mechanism raises or lowers the cutterhead quickly with a flip of a lever. The planer also sports a top-mounted thickness scale, a spring-loaded depth-of-cut gauge, double-edged disposable knives, and six preset depth stops (1¼", 1", ¾", ½", ¼", and ⅛").

Unfortunately, these stops on our test unit were too low, planing boards from 1/16" to 1/64" thinner than the stated thickness. Based on our findings, Craftsman's George Gibson says they've changed the manufacturing process to make the thickness gauge more accurate. (If you have an early model, call 800/266-9079 for a free replacement part.)

Other than that, the 21743 is a near-stellar performer. I couldn't slow the motor significantly even when taking 3/32"-deep cuts in 10"-wide oak and walnut. Snipe averaged an excellent .002–.003", with the higher numbers coming from wide or long workpieces and in softer woods, such as pine and poplar.



Craftsman 13" Portable Planer (model 21743)

Performance	★★★★☆
Price	$439
Value	★★★★☆

Available from your local Sears store or online at www.sears.com/craftsman.

—Tested by John Cebuhar

Continued on page 98

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Small sander with big-time features

If you're looking for a full-featured combination sander that won't break the bank, Jet's JSG-96 belt/disc sander—sporting a 9" disc, 6×48" belt, and a ¾-hp motor—may be your answer. I used the belt portion of the sander to slim down a bunch of 2"-wide pieces of red oak, and the belt didn't slow down a lick. The belt held its tracking well, even under heavy sanding pressure. And, when it came time to change grits, I found I could do it in less than a minute—even faster without the belt table installed.

That belt table is in addition to the JSG-96's beefy disc table, so you don't have to move it from one place to the other when switching from disc to belt or vice-versa. The disc table's perpendicular miter slots accept the included miter guide and a handy center point for sanding circles to size.

I found it unusual that the disc rotates clockwise, instead of the more typical counterclockwise. That means you sand on the right half of the disc instead of the left. Once I got used to that, though, I was satisfied with the accuracy of the disc. In fact, I measured only .003" runout on the disc platen.

I also found the dust-collection system on this sander effective, especially on the disc. A single 4" port collects dust from both the belt and disc, with separate on-board blast gates to direct the suction to the sanding surface in use.

The JSG-96 comes in three different configurations, depending on your preference and budget. The open-stand model I tested sells for about $380. The benchtop version costs $50 less; the closed-stand version, $50 more.

—Tested by Ben Von Ruden

Jet JSG-96 belt/disc sander

Performance	★★★★☆
Price	$380 (with open stand)
Value	★★★★☆

Call Jet Equipment & Tools at 800/274-6848, or visit www.jettools.com.

Continued on page 100

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Circle No. 1680, 1771

Aussie router great for down under the table

What would you call a 3¼-hp plunge router with a removable plunge-post spring, rack-and-pinion depth setting, and one-handed bit changing through the base? I'd call it the ideal router-table router, but the folks at Australia-based Triton Workshop Systems call it simply "½" Precision Router."

Cutting-depth changes, whether large or small, are a breeze with the ½" Precision Router. Squeezing the ring on one handle activates the "winder," an internal rack-and-pinion mechanism controlled by the handle. Rotating the handle a little more than half a turn plunges the motor through its full 2½" range. A microadjuster then lets you fine-tune the depth.

½" Precision Router (TRC001)

Performance	★★★★★
Price	$330
Value	★★★★★

Call Triton Workshop Systems toll-free at 888/874-8661, or visit www.tritonwoodworking.com.

An extra quarter-turn of the winder moves the ½" Precision Router into bit-changing mode. Now the collet protrudes through the base far enough to get a wrench on it, even when mounted to a ⅜"-thick router-table insert. At the same time, a pin automatically locks the spindle, and the power switch's sliding cover engages to prevent accidental startup. After changing bits, a slight backward turn of the winder returns the tool to ready-to-rout mode.

I found the winder worked best under the table. For handheld operations, such as plunging into a mortise, turning the handle caused the router to tip back and forth on the edge of my workpiece. For such occasions, a switch in the handle defeats the winder, so you can free-plunge the bit, then lock the cutting depth with a lever as on a more typical plunge router.

All of these features would be meaningless on an ill-fitted, underpowered router, but the ½" Precision Router is neither. I routed ½" mortises 1" deep with one pass in white oak and couldn't bog down the 15-amp, soft-start, variable-speed motor. And, with the winder engaged, I detected no play between the plunge posts and the body's bronze bushings, even without the plunge lock activated.

Before you balk at the $330 price—near the top for a router in this category—you should know that the tool comes with an easy-to-attach edge guide/circle-routing trammel, and a ½" carbide-tipped straight bit. Those items cost $50–$70 if you buy them separately.

—Tested by Garry Smith

Continued on page 102

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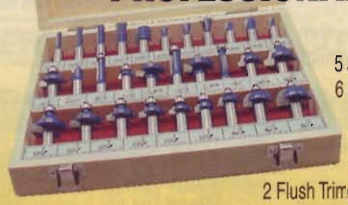
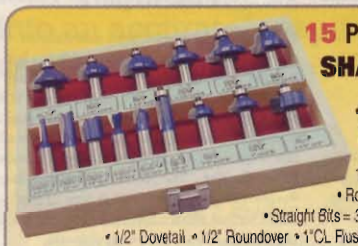
All Woodline USA Products Feature Tough Micro Grain *Carbide*

30 Piece PROFESSIONAL SET



Includes:
5 Straight Bits
6 Roundovers
3 Dovetails
3 Core Box
3 Cove Bits
2 Flush Trim, 1 Panel Bit
2 Roman Ogee, 2 slot cutters, 1 "V" Groove
1 Chamfer and 1 Bevel Trim Bit **SUPER BUY**
WL-2010 **OUR PRICE *ONLY* $109 set**

15 Piece 1/2" SHANK SET



Includes:
• Chamfer • Cove = 1/2"R, 3/8"R, 1/4"R
• Roundover = 1/2"R, 3/8"R, 1/4"R
• Roman Ogee = 1/4"R
• Straight Bits = 3/4"R, 1/2"R, 1/4"R
• 1/2" Dovetail • 1/2" Roundover • 1"CL Flush Trim • Rabbet Bit
WL-2022 for 1/2" or WL-2021 for 1/4"SHANK SET
OUR PRICE *ONLY* $59 each set

5 Piece DOVETAIL SET

• 14° 3/4" • 14° 5/8"
• 8° 1/2" • 14° 1/2"
• 14° 3/8"
1/2" Shank Router Bits
WL-2017
$30 VALUE
OUR PRICE ONLY $19 set

8 Piece PICTURE FRAME SET

Perfect for making great looking picture frames. Bits can be combined to form complex mouldings or simple decorative frames.

WL-2008 $189 VALUE
OUR PRICE ONLY $75 set

3 Piece CABINET DOOR SET

1/2" Shank Router Bits • 2-pc Roman Ogee Rail & Stile • 3 1/4" Panel Raiser
WL-2019-1 $129 VALUE
OUR PRICE ONLY $75 set

1/2" Shank Router Bits

6 Piece CABINET DOOR SET

1/2" Shank Router Bits
• 2-pc Rail & Stile (Roman Ogee) • Drawer Lock
• 3 1/4" D Panel Raiser (Ogee) • Door Lip • Glue Joint
WL-2020-1 $175 VALUE
OUR PRICE ONLY $119 set

5 Piece CABINET DOOR SET

3/4" Bore Shaper Cutter
• 1-pc Rail & Stile (Roman Ogee)
• 4 5/8" Panel Raiser (Ogee)
• Door Lip
• Glue Joint
• Drawer Lock
WL-1505 $279 VALUE
OUR PRICE ONLY $179 set

5 Piece MOULDING SET

1/2" Shank Router Bits WL-2011 $175 VALUE
OUR PRICE ONLY $99 set

13 Piece DOVETAIL SET

1/2" Shank Router Bits
• 3 Straight Bits
• 10 Dovetail Bits
WL-2014
$125 VALUE
OUR PRICE ONLY $49 set

9 Piece MASTER DADO SET

Includes Undersize for Plywood, Standard for Hardwood and Oversize for Melamine or Veneered Materials In 3 Popular Sizes: 1/4", 1/2" and 3/4".

WL-2030
$89 VALUE
OUR PRICE ONLY $49 set

5 Piece COVE SET

1/4"R • 3/8"R • 1/2"R • 5/8"R • 3/4"R
WL-2015 $99 VALUE
OUR PRICE ONLY $49 set

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• MOST ITEMS IN STOCK • SAME DAY SHIPPING

QUALITY Guaranteed

Circle No. 310

Hearing protection only when you need it

If hearing that wonderful praise about your craftsmanship is important to you, then you want to protect your ears for the long haul. Over & Out Electronic Hearing Protectors cut the noise getting to your ears by 28 decibels (dB), which is more than you need in most woodworking shops. But the real advantage over other types of protection is that they block sound only when they need to.

A tiny microphone mounted on one earpiece pipes normal sounds and conversation into your ears. But when you fire up a tool that rises above the 85 dB noise level that experts consider dangerous, muting circuitry kicks in and shuts off the mic.

It takes a fraction of a second to mute, so I heard just the first tiny bit of the sudden pop! from a pneumatic brad nailer. But it did shut out most of the driving noise and the loud rush of exhausted air.

Over & Out Electronic Hearing Protectors feel a bit heavier than other muffs I've used. Still, I found them comfortable to wear for long periods of time. The device requires a pair of AA batteries, and a bright red LED serves as a reminder when you've left them powered up.

—Tested by Jeff Hall

Over & Out Electronic Hearing Protectors

Performance	★★★★★
Price	$60
Value	★★★★★

To locate a dealer, call Power Aisle, Inc., at 631/673-5975.

About our product testers

John Cebuhar *is a retired wood-shop teacher.* **Jeff Hall** *teaches woodworking and other technical skills to high-school students.* **Garry Smith** *is a machinist.* **Ben Von Ruden** *helps restore antique jukeboxes. All are avid woodworkers.*

what's ahead

Just some of the articles in the December issue of *WOOD*® (on sale November 26)

Projects

Arts & Crafts rocking chair
Simplified construction techniques put the building of this classic furniture piece within reach of any woodworker. You'll learn how to leave off the rockers and build it as a chair, too.

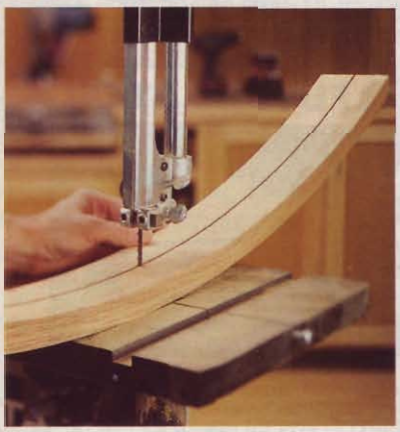
Dragon pull toy
Kids will love the way this flexible character snaps his head and tail side-to-side when towed across the floor.

Cherry wall mirror
Got a tablesaw and drill? That's all you need to build this 27¼×39¼" stunner. Feel free to tweak its dimensions to suit your needs.

Inlaid serving tray
Fancy yet functional defines this weekend project. You may be surprised at how easily you can inlay the decorative butterflies using a router-bit setup.

Tools, Techniques, & Features

Sharpening machines compared
We test nine machines, priced from $90 to $600, that promise to keep tool edges cool and super sharp.



How to laminate curved shapes
Make bent workpieces, like the rockers on the chair, *above left*, using the tips and tricks provided in this article.

Meet the tray master
See how Delaware craftsman Ken Schubert fashions finely veneered oval trays using unique homemade gizmos.